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PATENT ABSTRACTS OF JAPAN

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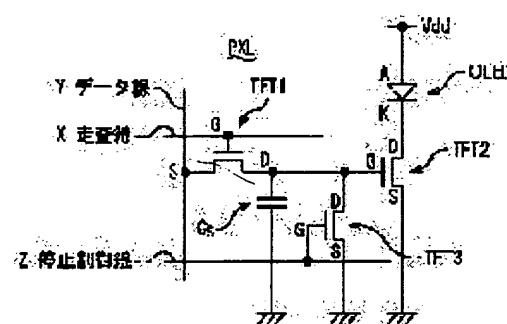
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(54) PICTURE DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To perform the satisfactory design of a picture display device by increasing the degree of freedom in designing active elements inside of pixels and to make freely and simply adjustable the display luminance of the device.

SOLUTION: Each pixel PXL includes a light emitting element OLED whose luminance is changed by the amount of a current to be supplied, a TFT 1 which is controlled by a scanning line X and has a function writing luminance information applied from a data line Y to the pixel and a TFT 2 having a function controlling the amount of the current to be supplied to the OLED in accordance with the written luminance information. The writing of the luminance information to each pixel PXL applies an electric signal in accordance with the luminance information to the data line Y in a state in which the scanning line X is selected. The luminance information written in each pixel is held at each pixel even after the scanning line X becomes a non-selection and a light emitting element of each pixel can maintain the lighting with the luminance in accordance with the held information. Moreover, this device has a stoppage control line Z forcibly turning off the light emitting elements of respective pixels connected to the same scanning line X at least with a scanning unit and the line Z makes respective light emitting element to be in turned-off states from the turned-on states in the interval of a scanning cycle when the information are written in for every pixel, then a new luminance information is to be written in it.



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CLAIMS**[Claim(s)]**

[Claim 1] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, The second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** is included. The writing of the brightness information to each pixel It is carried out by impressing the electrical signal according to brightness information to the data line, where the scanning line is chosen. In the image display device which can maintain lighting by the brightness according to the brightness information by which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held It has the control means which switches off compulsorily at least the light emitting device of each pixel connected to the same scanning line per scanning line. The image display device characterized by changing a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 2] Said control means is an image display device according to claim 1 characterized by the ability to adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 3] Said control means contains the third active element connected to the gate of this second active element that consists of an insulated gate field effect transistor. It is possible to control the gate potential of this second active element by the control signal given to this third active element, and to switch off this light emitting device. This control signal The image display device according to claim 1 characterized by being given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel.

[Claim 4] It is the image display device according to claim 1 characterized by being given to the third active element contained in each pixel on the same scanning line through the halt control line which said control means can intercept the current which flows to this light emitting device according to the control signal given to this third active element including the third active element connected with this light emitting device at the serial, and formed this control signal in each scanning line and parallel.

[Claim 5] It is the image display device according to claim 1 which each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, and common connection of the other-end child is made in each pixel on the same scanning line, and is electrically separated between the scanning lines, and is characterized by for said control means controlling the potential of the other-end child by whom common connection of the two terminal each component was made, and switching off a two terminal each component.

[Claim 6] Said control means is an image display device according to claim 1 characterized by writing in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switching off the light emitting device of each pixel while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 7] Said control means is an image display device according to claim 1 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off this light emitting device by controlling the potential of the other end of this capacitative element including the capacitative element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element by which each pixel controls the amount of currents which flows to this light

emitting device.

[Claim 8] Said control means is an image display device according to claim 1 characterized by controlling at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time per scanning line within the back 1 scan cycle by which brightness information was written in each pixel.

[Claim 9] It is the image display device according to claim 1 characterized by said control means switching off the light emitting device contained in each pixel of red, green, and blue when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 10] Said light emitting device is an image display device according to claim 1 characterized by being an organic electroluminescent element.

[Claim 11] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, It is the drive approach of the image display device containing the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** , and the writing of the brightness information to each pixel is in the condition that the scanning line was chosen. It is carried out by impressing the electrical signal according to brightness information to the data line. The brightness information written in each pixel is held at each pixel, even after the scanning line is un-choosing. The light emitting device of each pixel maintains lighting by the brightness according to the held brightness information. The light emitting device of each pixel connected to the same scanning line can be compulsorily switched off per scanning line at least. The drive approach of the image display device characterized by changing a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 12] The drive approach of the image display device according to claim 11 characterized by the ability to adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 13] It is the drive approach of the image display device according to claim 11 characterized by giving the third active element contained in each pixel on the same scanning line through the halt control line which it is possible to connect the third active element to the gate of this second active element that consists of an insulated gate field effect transistor, to control the gate potential of this second active element by the control signal given to this third active element, and to switch off this light emitting device, and formed this control signal in each scanning line and parallel.

[Claim 14] It is the drive approach of the image display device according to claim 11 characterized by giving the third active element contained in each pixel on the same scanning line through the halt control line which it is possible to intercept the current which flows to this light emitting device according to the control signal which connects the third active element to this light emitting device and a serial, and is given to this third active element, and formed this control signal in each scanning line and parallel.

[Claim 15] It is the drive approach of the image display device according to claim 11 which each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, and common connection of the other-end child is made in each pixel on the same scanning line, and is characterized by dissociating electrically, controlling the potential of the other-end child by whom common connection of the two terminal each component was made between the scanning lines, and switching off a two terminal each component.

[Claim 16] The drive approach of the image display device according to claim 11 characterized by writing in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switching off the light emitting device of each pixel while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 17] Each pixel is the drive approach of the image display device according to claim 11 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element by controlling the potential of the other end of this capacitative element including the capacitative element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element which controls the amount of currents which flows to this light emitting device, and switching off this light emitting device.

[Claim 18] The drive approach of the image display device according to claim 11 characterized by controlling at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time per scanning line within the

back 1 scan cycle by which brightness information was written in each pixel.

[Claim 19] The drive approach of the image display device according to claim 11 characterized by switching off red, green, and the light emitting device contained in each blue pixel when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 20] Said light emitting device is the drive approach of the image display device according to claim 11 characterized by using an organic electroluminescent element.

[Claim 21] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, The second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** is included. The writing of the brightness information to each pixel It is carried out by impressing the electrical signal according to brightness information to the data line, where the scanning line is chosen. In the image display device which can maintain lighting by the brightness according to the brightness information by which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held It has the control means which switches off compulsorily the light emitting device of each pixel connected to each scanning line. It is the image display device which changes a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel. It is the image display device characterized by said control means switching off the light emitting device contained in each pixel of red, green, and blue when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 22] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, It is the drive approach of the image display device containing the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** , and the writing of the brightness information to each pixel is in the condition that the scanning line was chosen. It is carried out by impressing the electrical signal according to brightness information to the data line. The brightness information written in each pixel is held at each pixel, even after the scanning line is un-choosing. The light emitting device of each pixel maintains lighting by the brightness according to the held brightness information. The light emitting device of each pixel connected to each scanning line can be switched off compulsorily. It is the drive approach which changes a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel. The drive approach of the image display device characterized by switching off red, green, and the light emitting device contained in each blue pixel when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 23] In the image display device which turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in after the first brightness information is written in a pixel The data line which gives the brightness information for being formed in the direction which intersects perpendicularly with the scanning line which chooses each pixel in a predetermined scan cycle, and this scanning line, and turning on the above-mentioned pixel, The first active element which is controlled by the above-mentioned scanning line and incorporates the above-mentioned brightness information, The image display device characterized by having the second active element which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel, and having the control means which changes the above-mentioned pixel into a putting-out-lights condition from a lighting condition within the above-mentioned 1 scan cycle period.

[Claim 24] The above-mentioned control means is an image display device according to claim 23 characterized by adjustable being possible in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out] within the above-mentioned 1 scan cycle period.

[Claim 25] It is the image display device according to claim 23 which the second active element of the above is an insulated gate field effect transistor, and the above-mentioned control means has the third active element connected to the gate of this insulated gate field effect transistor, and is characterized by controlling this third active element by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 26] It is the image display device according to claim 23 which the above-mentioned control means has the third active element prepared in the second active element of the above at the serial, and is characterized by controlling this third active element by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 27] It is the image display device according to claim 23 which, as for the above-mentioned light emitting device, the above-mentioned pixel has the first and the second terminal including a light emitting device, the second terminal of the above is connected to predetermined reference potential while the first terminal of the above is connected to the second active element of the above, and is characterized by the above-mentioned control means making the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential.

[Claim 28] The above-mentioned control means is an image display device according to claim 23 characterized by switching off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen.

[Claim 29] The above-mentioned control means is an image display device according to claim 23 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off a pixel by controlling the potential of the other end of this capacitive element including the capacitive element by which the end was connected to the gate of an insulated gate field effect transistor where each pixel constitutes this second active element.

[Claim 30] The above-mentioned control means is an image display device according to claim 23 characterized by switching off the above-mentioned pixel for every above-mentioned scanning line.

[Claim 31] It is the image display device according to claim 23 which the above-mentioned pixel has the light emitting device of blue, green, and red, and is characterized by the ability of the above-mentioned control means to switch off the light emitting device of this blue, green, and red by different time amount.

[Claim 32] It is the image display device according to claim 23 which the second active element of the above converts brightness information into the current used for the drive of a pixel, and is characterized by each pixel having a light emitting device using the organic substance which emits light according to a current.

[Claim 33] It has the scanning-line drive circuit where the perpendicular clock for making sequential selection of the above-mentioned scanning line is inputted. The above-mentioned control means It has the control circuit which chooses the control line which the predetermined perpendicular clock which carried out period delay was inputted, and formed the above-mentioned perpendicular clock in the above-mentioned scanning line or this, and parallel. The above-mentioned scanning line While sequential selection is made by the above-mentioned scanning-line drive circuit synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel The image display device according to claim 23 characterized by switching off this pixel through the above-mentioned control line within the above-mentioned 1 scan period synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] after this lighting in this control circuit.

[Claim 34] It is the image display device according to claim 33 which has the data-line drive circuit which gives brightness information to the above-mentioned data line, and is characterized by for the output of the above-mentioned control circuit to be connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit while the output of the above-mentioned scanning-line drive circuit is connected to one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line, and to be inputted the above-mentioned perpendicular clock into the input terminal of another side of this AND circuit.

[Claim 35] In the drive approach of the image display device which turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in after the first brightness information is written in a pixel The procedure which chooses each pixel in a predetermined scan cycle through the scanning line, Through the data line formed in the direction which intersects perpendicularly with this scanning line by the procedure of giving the brightness information for turning on the above-mentioned pixel, the procedure of incorporating the above-mentioned brightness information to a pixel by the first active element controlled by the above-mentioned scanning line, and the second active element The drive approach of the image display device characterized by performing the procedure which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel, and the control-procedure stage which changes the above-mentioned pixel into a putting-out-lights condition from a lighting condition within the above-mentioned 1 scan cycle period.

[Claim 36] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by adjustable being possible in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out] within the above-mentioned 1 scan cycle period.

[Claim 37] It is the drive approach of the image display device according to claim 35 which the insulated gate field effect transistor is used for the second active element of the above, performs the above-mentioned control procedure using the third active element connected to the gate of this insulated gate field effect transistor, and is characterized by controlling this third active element by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 38] This third active element is the drive approach of the image display device according to claim 35 characterized by being controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel using the third active element by which the above-mentioned control procedure was formed in the second active element of the above at the serial.

[Claim 39] It is the drive approach of the image display device according to claim 35 which, as for the above-mentioned light emitting device, the above-mentioned pixel has the first and the second terminal including a light emitting device, the second terminal of the above is connected to predetermined reference potential while the first terminal of the above is connected to the second active element of the above, and is characterized by the above-mentioned control procedure making the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential.

[Claim 40] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by switching off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen.

[Claim 41] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off a pixel by controlling the potential of the other end of this capacitive element including the capacitive element by which the end was connected to the gate of an insulated gate field effect transistor where each pixel constitutes this second active element.

[Claim 42] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by switching off the above-mentioned pixel for every above-mentioned scanning line.

[Claim 43] It is the drive approach of the image display device according to claim 35 which the above-mentioned pixel has the light emitting device of blue, green, and red, and is characterized by the ability of the above-mentioned control procedure to switch off the light emitting device of this blue, green, and red by different time amount.

[Claim 44] It is the drive approach of the image display device according to claim 35 which the second active element of the above converts brightness information into the current used for the drive of a pixel, and is characterized by each pixel having a light emitting device using the organic substance which emits light according to a current.

[Claim 45] The scanning-line drive procedure which inputs the perpendicular clock for making sequential selection of the above-mentioned scanning line, The perpendicular clock with which predetermined carried out period delay of the above-mentioned perpendicular clock is inputted, and the control procedure which chooses the above-mentioned scanning line or the control line formed in parallel as having come is performed. The above-mentioned scanning line While sequential selection is made by the above-mentioned scanning-line drive procedure synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel The drive approach of the image display device according to claim 35 characterized by switching off this pixel through the above-mentioned scanning line or the control line within the above-mentioned 1 scan period synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] with this control procedure after this lighting.

[Claim 46] The output of the above-mentioned scanning-line drive procedure is the drive approach of the image display device according to claim 45 characterized by for the output of the above-mentioned control procedure to be connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit, and to be inputted the above-mentioned perpendicular clock into the input terminal of another side of this AND circuit while connected with one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line including the data-line drive procedure give brightness information to the above-mentioned data line.

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DETAILED DESCRIPTION**[Detailed Description of the Invention]**

[0001]

[Field of the Invention] This invention relates to the image display device equipped with the pixel by which brightness is controlled by the signal. For example, it is related with the image display device equipped with the light emitting device by which brightness is controlled by currents, such as an organic electroluminescence (EL) component, for every pixel. It is related with the so-called active-matrix type with which the amount of currents supplied to a light emitting device is controlled by active elements, such as an insulated gate field effect transistor prepared in each pixel, in more detail of image display device.

[0002]

[Description of the Prior Art] An image is displayed by arranging many pixels in the shape of a matrix, and generally, controlling optical reinforcement by the image display device of a active-matrix mold for every pixel according to the given brightness information. When liquid crystal is used as electrooptic material, the permeability of a pixel changes according to the electrical potential difference written in each pixel. It is the same as that of the case where fundamental actuation uses liquid crystal also with the image display device of the active-matrix mold using the organic electroluminescence ingredient as electrooptic material. However, unlike a liquid crystal display, an organic electroluminescence display is the so-called spontaneous light type which has a light emitting device in each pixel, and has an advantage, like a back light with the high visibility of an image has needlessness and a quick speed of response compared with a liquid crystal display. The brightness of each light emitting device is controlled by the amount of currents. That is, in that a light emitting device is a current drive mold or a current control mold, a liquid crystal display etc. is large and it differs.

[0003] A passive matrix and an active matrix are possible also for an organic electroluminescence display as the drive method like a liquid crystal display. Although structure of the former is simple, since implementation of a large-sized and high definition display is difficult, development of an active matrix is performed briskly. An active matrix is controlled by the active element (generally it may call the thin film transistor which is a kind of an insulated gate field effect transistor, and Following TFT) which prepared the current which flows to the light emitting device prepared in each pixel in the interior of a pixel. The organic electroluminescence display of this active matrix is indicated by JP,8-234683,A, and shows the equal circuit for 1 pixel to drawing 10 . Pixel PXL consists of a light emitting device OLED, the first thin film transistor TFT1, the second thin film transistor TFT2, and retention volume Cs. A light emitting device is an organic electroluminescence (EL) component. Since an organic EL device has a rectifying action in many cases, it may be called OLED (organic light emitting diode), and uses the notation of diode as a light emitting device OLED by a diagram. However, a light emitting device is not necessarily restricted to OLED, and brightness should just be controlled by the amount of currents which flows for a component. Moreover, a rectifying action is not necessarily required of a light emitting device. In the example of illustration, the source S of TFT2 is made into a reference potential (touch-down potential), and while the anode A of a light emitting device OLED (anode plate) is connected to Vdd (power-source potential), Cathode K (cathode) is connected to the drain D of TFT2. On the other hand, the gate G of TFT1 is connected to the scanning line X, Source S is connected to data-line Y, and Drain D is connected to the gate G of retention volume Cs and TFT2.

[0004] In order to operate PXL, first, the scanning line X is made into a selection condition, if the data potential Vdata which expresses brightness information to data-line Y is impressed, TFT1 flows, retention volume Cs charges or discharges, and the gate potential of TFT2 is in agreement with the data potential Vdata. If the scanning line X is made into the condition of not choosing, TFT1 becomes off, and although TFT2 is electrically separated from data-line Y, the gate potential of TFT2 will be held with retention volume Cs at stability. The current which flows to a light emitting

device OLED through TFT2 serves as a value according to the gate / electrical potential difference V_{gs} between the sources of TFT2, and a light emitting device OLED continues emitting light by the brightness according to the amount of currents supplied from TFT2.

[0005] On these specifications, actuation of choosing the scanning line X and telling the potential of data-line Y to the interior of a pixel is called "writing" below. Now, when the current which flows between the drain/source of TFT2 is set to I_{ds} , this is the drive current which flows to OLED. I_{ds} is expressed with the following formulas when TFT2 shall operate in a saturation region.

$$I_{ds} = (1/2) \cdot \mu \cdot C_{ox} \cdot (W/L) \cdot (V_{gs} - V_{th})^2 = (1/2) \cdot \mu \cdot C_{ox} \cdot (W/L) \cdot (V_{data} - V_{th})^2 \quad (1)$$

C_{ox} is the gate capacitance of the unit area neighborhood, and is given by the following formulas here.

$$C_{ox} = \epsilon_0 \text{ and } \epsilon_r / d \quad (2)$$

V_{th} shows the threshold of TFT2 among a formula (1) and (2), μ shows the mobility of a carrier, W shows channel width, L shows channel length, ϵ_0 shows the dielectric constant of vacuum, ϵ_r shows the specific inductive capacity of gate dielectric film, and d is the thickness of gate dielectric film.

[0006] According to the formula (1), I_{ds} can be controlled by the potential V_{data} written in Pixel PXL, and the brightness of a light emitting device OLED can be controlled by it as a result. Here, the reason for operating TFT2 in a saturation region is as follows. That is, in order to control I_{ds} only by V_{gs} in a saturation region and not to be dependent on a drain / electrical potential difference V_{ds} between the sources, even if it changes V_{ds} by property dispersion of OLED, it is because the current I_{ds} of the specified quantity can be passed to OLED.

[0007] As mentioned above, once it writes in V_{data} , by the circuitry of the pixel PXL shown in drawing 10, OLED will continue luminescence by fixed brightness between 1 scan cycles (one frame) until it is rewritten next. If a majority of such pixels PXL are arranged in the shape of a matrix like drawing 11, a active-matrix mold image display device can be constituted. As shown in drawing 11, the scanning line X1 for the conventional image display device to choose Pixel PXL in a predetermined scan cycle (for example, frame period according to the NTSC standard) thru/or XN, and data-line Y that gives the brightness information (data potential V_{data}) for driving Pixel PXL are arranged in the shape of a matrix. While the scanning line X1 thru/or XN are connected to the scanning-line drive circuit 21, data-line Y is connected to the data-line drive circuit 22. A desired image can be displayed by repeating the writing of data-line Y to V_{data} by the data-line drive circuit 22, making sequential selection of the scanning line X1 thru/or the XN by the scanning-line drive circuit 21. With the image display device of a passive-matrix mold, with the active-matrix mold image display device shown in drawing 11 to emitting light only at the moment of being chosen, in order that the light emitting device of each pixel PXL may continue luminescence also even for after write-in termination, the light emitting devices contained in each pixel PXL are points -- compared with a passive-matrix mold, the peak brightness (peak current) of a light emitting device can be lowered -- and become advantageous on a high definition, especially large-sized display.

[0008] Drawing 12 is the representative circuit schematic showing other examples of the conventional pixel structure, gives a corresponding reference number to the previous conventional example shown in drawing 10, and a corresponding part, and makes an understanding easy. In this conventional example, the field-effect transistor of a P channel mold is used to the previous conventional example having used the field-effect transistor of an N channel mold as TFT1 and TFT2. Therefore, contrary to the circuitry of drawing 10, the cathode K of OLED connected with V_{dd} of negative potential, and Anode A has connected with the drain D of TFT2.

[0009] Drawing 13 expresses typically the cross-section structure of the pixel PXL shown in drawing 12. However, in order to make illustration easy, only TFT2 is expressed as OLED. OLED piles up a transparent electrode 10, the organic electroluminescence layer 11, and a metal electrode 12 in order. It has dissociated for every pixel, and a transparent electrode 10 functions as an anode A of OLED, for example, consists of transparence electric conduction film, such as ITO. Common connection of the metal electrode 12 is made between pixels, and it functions as a cathode K of OLED. That is, common connection of the metal electrode 12 is made at the predetermined power-source potential V_{dd} . The organic electroluminescence layer 11 serves as bipolar membrane which piled up for example, the electron hole transportation layer and the electronic transportation layer. For example, Diamyne is vapor-deposited as an electron hole transportation layer on the transparent electrode 10 which functions as an anode A (hole-injection electrode), Alq3 is vapor-deposited as an electronic transportation layer on it, and the metal electrode 12 which functions as a cathode K (electron injection electrode) on it further is formed. In addition, Alq3 is 8-hydroxy. quinoline aluminum is expressed. OLED which has such a laminated structure is only an example. If the electrical potential difference (about 10V) of the forward direction is impressed between the anode/cathode of OLED which has this configuration, impregnation of carriers, such as an electron and an electron hole, will take place, and luminescence will be observed. Actuation of OLED is considered to be luminescence by the exciton formed from the electron hole poured in from the electron hole

transportation layer, and the electron poured in from the electronic transportation layer.

[0010] On the other hand, TFT2 consists of the gate electrode 2 formed on the substrate 1 which consists of glass etc., gate dielectric film 3 put on that top face, and a semi-conductor thin film 4 piled up above the gate electrode 2 through this gate dielectric film 3. This semi-conductor thin film 4 consists for example, of a polycrystalline silicon thin film. TFT2 is equipped with Source S, Channel Ch, and Drain D used as the path of the current supplied to OLED. Channel Ch is exactly located in right above [of the gate electrode 2]. TFT2 of this bottom gate structure is covered with the interlayer insulation film 5, and the source electrode 6 and the drain electrode 7 are formed on it. On these, OLED mentioned above through another interlayer insulation film 9 is formed.

[0011]

[Problem(s) to be Solved by the Invention] The first technical problem which should be solved when the EL display of the active-matrix mold mentioned above is constituted has the small design degree of freedom of TFT2 which is the active element which controls the amount of currents which flows to OLED, and the practical design doubled with the pixel dimension depending on the case becomes difficult. Moreover, the second technical problem which should be solved is that it is difficult to adjust the display brightness of the whole screen free. It explains mentioning a design parameter concrete about the conventional example which showed these technical problems to drawing 10 thru/or 13. 1000 and a pixel dimension in the typical example of a design $S=200\text{micrometer} \times 200\text{micrometer}$, [a screen size] [the number of 20cmx20cm and lines (scanning-line number)] [the number of 1000 and trains (number of the data line)] $B_p=200\text{ cd/m}^2$ and the luminescence efficiency of element $E=10\text{ cd/A}$, [peak brightness] $\epsilon_r=3.9$ and carrier mobility $\mu=100\text{cm}^2/\text{V}\cdot\text{s}$, [the thickness of the gate dielectric film of TFT2] [the specific inductive capacity of $d=100\text{nm}$ and gate dielectric film] The peak current per pixel is [the peak value of $I_p=B_p/E_x S=0.8\text{microA}$ and $|V_{gs}-V_{th}|$ (driver voltage)] $V_{gs}=5\text{V}$. In order to supply the peak current I_p in such an example of a design, as an example of a design of TFT2, it is as follows from the formula (1) mentioned above and (2).

Channel width: $W=5\text{ micrometers}$ Channel length: $L=\{W/(2, I_p)\}$ and $2=270\text{ micrometers}$ (3) of $\mu\text{-Cox-}$

[0012] I hear that channel length L given by the formula (3) is the dimension which is equal to pixel size ($S=200\text{micrometer} \times 200\text{micrometer}$), or exceeds this, and all that matters first here has it. As shown in a formula (3), the peak current I_p is in inverse proportion to channel length L . In the above-mentioned example, in order to suppress the peak current I_p about [required for actuation / sufficient / 0.8micro] to A, channel length L must be lengthened to 270 micrometers. Now, since the occupancy area of TFT2 in a pixel becomes large and a result which narrows a luminescence field is brought, it is not only desirable, but detailed-ization of a pixel becomes difficult. When the parameter of the brightness (peak current) and the semi-conductor process that an essential problem is required etc. is given, I hear that there are not most design degrees of freedom of TFT2, and there are. That is, in order to make channel length L small in the above-mentioned example, it is possible to make channel width W small first so that clearly from a formula (3). However, it is difficult for a limitation to be in detailed-ization of process top channel width W , and to make it detailed in a current thin film transistor process more sharply than above-mentioned extent. As an option, it is possible to make peak value I_p of driver voltage small. However, in order to perform gradation control in that case, it will be necessary to control the luminescence reinforcement of OLED by very small driver voltage width of face. For example, if it is going to control luminescence reinforcement by 64 gradation in the case of $V_{gs}=5\text{V}$, the electrical-potential-difference step per 1 gradation will be set to $5\text{V} / \text{about } 64 = 80\text{mV}$ on an average. Making this still smaller brings a result in which the display quality of an image is influenced by dispersion in few noises and TFT properties. Therefore, there is a limitation also in making peak value I_p of driver voltage small. It is possible to set process parameters, such as the carrier mobility μ which appears in a formula (3), as a suitable value as another solution. However, generally it is difficult to control a process parameter with a sufficient precision to a convenient value, and it is not economically realistic to build a manufacture process according to the specification of the image display device which it is going to design primarily at all. Thus, in the conventional active-matrix mold EL display, the degree of freedom of a pixel design is scarce, and it is difficult to perform a practical design.

[0013] Although connected also with the first trouble mentioned above, it is difficult as the second trouble to control the display brightness of the whole screen by the EL display of a active-matrix mold to arbitration. Generally, it is practically indispensable requirements that the display brightness of the whole screen can be adjusted free in image display devices, such as television. For example, when making screen intensity high when a perimeter uses an image display device under a bright situation, and using an image display device under a conversely dark situation, it is natural to stop screen intensity low. Accommodation of such screen intensity is easily realizable by changing the power of a back light in a liquid crystal display. Moreover, in the EL display of a passive-matrix mold, screen intensity can be adjusted comparatively easily by adjusting the drive current at the time of the address.

[0014] However, in the organic display of a active-matrix mold, it is difficult to adjust the display brightness as the

whole screen to arbitration. As mentioned above, display brightness is proportional to the peak current I_p , and I_p is in inverse proportion to channel length L of TFT2. Therefore, although what is necessary is just to enlarge channel length L in order to lower display brightness, this cannot serve as a means by which a user chooses display brightness as arbitration. As a realizable approach, in order to lower brightness, it is possible to make peak value **** of driver voltage small. However, if **** is lowered, degradation of image quality will be caused by causes, such as a noise. Conversely, even if it is going to enlarge peak value **** of driver voltage, it cannot be overemphasized that there is an upper limit by pressure-proofing of TFT2 etc. to raise brightness.

[0015]

[Means for Solving the Problem] the technical problem of a Prior art mentioned above -- taking an example -- this invention -- the design degree of freedom of the active element inside a pixel -- increasing -- a good design -- possible ** -- it is -- it aims at offering the image display device which can adjust screen intensity free and simple with **. The following means were provided in order to attain this purpose. The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Namely, each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, The second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** is included. The writing of the brightness information to each pixel It is carried out by impressing the electrical signal according to brightness information to the data line, where the scanning line is chosen. In the image display device which can maintain lighting by the brightness according to the brightness information by which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held After having the control means which switches off compulsorily at least the light emitting device of each pixel connected to the same scanning line per scanning line and writing brightness information in each pixel, while being the 1 scan cycle in which brightness information new next is written, it is characterized by changing a light emitting device into a putting-out-lights condition from a lighting condition.

[0016] Preferably, said control means can adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition, while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel. With 1 operation gestalt, the gate potential of this second active element is controlled with the control signal given to this third active element including the third active element connected to the gate of this second active element that consists of an insulated gate field effect transistor, said control means can switch off this light emitting device, and this control signal is given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel. With other operation gestalten, said control means can intercept the current which flows to this light emitting device according to the control signal given to this third active element including the third active element connected with this light emitting device at the serial, and this control signal is given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel. With another operation gestalt, between the scanning lines, each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, common connection of the other-end child is made in each pixel on the same scanning line, and it dissociates electrically, and said control means controls the potential of the other-end child by whom common connection of the two terminal each component was made, and switches off a two terminal each component. Furthermore, with another operation gestalt, after brightness information is written in each pixel, while being the 1 scan cycle in which brightness information new next is written, said control means writes in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switches off the light emitting device of each pixel. Furthermore, including the capacitive element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element to which each pixel controls the amount of currents which flows to this light emitting device by another operation gestalt, by controlling the potential of the other end of this capacitive element, said control means controls the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switches off this light emitting device. Furthermore, said control means controls at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time by another operation gestalt per scanning line within the back 1 scan cycle by which brightness information was written in each pixel. Furthermore, with another operation gestalt, while connecting each pixel of red, green, and blue to the same scanning line in common, said control means switches off red, green, and the light emitting device contained in each blue pixel, when separate. In addition, said light emitting device is an organic electroluminescent element preferably.

[0017] In the image display device with which this invention turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in again after the first brightness information is written in a pixel. The data line which gives the brightness information for being formed in the direction which intersects perpendicularly with the scanning line which chooses each pixel in a predetermined scan cycle, and this scanning line, and turning on the above-mentioned pixel, The first active element which is controlled by the above-mentioned scanning line and incorporates the above-mentioned brightness information, It is characterized by having the second active element which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel, and having the control means which changes the above-mentioned pixel into a putting-out-lights condition from a lighting condition within the above-mentioned 1 scan cycle period. Preferably, adjustable is possible for the above-mentioned control means within the above-mentioned 1 scan cycle period in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out]. Moreover, the second active element of the above is an insulated gate field effect transistor, the above-mentioned control means has the third active element connected to the gate of this insulated gate field effect transistor, and this third active element is controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel. Moreover, the above-mentioned control means has the third active element prepared in the second active element of the above at the serial, and this third active element is controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel. Moreover, as for the above-mentioned light emitting device, the above-mentioned pixel has the first and the second terminal including a light emitting device, while the first terminal of the above is connected to the second active element of the above, the second terminal of the above is connected to predetermined reference potential, and the above-mentioned control means makes the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential. Moreover, the above-mentioned control means switches off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen. Moreover, including the capacitive element by which the end was connected to the gate of an insulated gate field effect transistor where each pixel constitutes this second active element, by controlling the potential of the other end of this capacitive element, the above-mentioned control means controls the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switches off a pixel. Moreover, the above-mentioned control means switches off the above-mentioned pixel for every above-mentioned scanning line. Moreover, the above-mentioned pixel has the light emitting device of blue, green, and red, and the above-mentioned control means can switch off the light emitting device of this blue, green, and red by different time amount. Moreover, the second active element of the above converts brightness information into the current used for the drive of a pixel, and each pixel has a light emitting device using the organic substance which emits light according to a current. Moreover, the scanning-line drive circuit where the perpendicular clock for making sequential selection of the above-mentioned scanning line is inputted, It has the control circuit which chooses the control line which the predetermined perpendicular clock which carried out period delay was inputted, and formed the above-mentioned perpendicular clock in the above-mentioned scanning line or this, and parallel. The above-mentioned scanning line While sequential selection is made by the above-mentioned scanning-line drive circuit synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel, synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] in this control circuit, this pixel is switched off through the above-mentioned scanning line or the control line after this lighting within the above-mentioned 1 scan period. Furthermore, it has the data-line drive circuit which gives brightness information to the above-mentioned data line, and while the output of the above-mentioned scanning-line drive circuit is connected to one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line, the output of the above-mentioned control circuit is connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit, and the above-mentioned perpendicular clock is inputted into the input terminal of another side of this AND circuit.

[0018] According to this invention, after writing brightness information in each pixel per scanning line, before newly writing in the brightness information of the following scanning-line cycle (frame), an image display device bundles up the light emitting device contained in each pixel per scanning line, and is switched off. According to this, time amount until it puts out the light from lighting of the write-in late-coming light corpuscle child of brightness information can be adjusted. That is, the luminescence time amount in a 1 scan cycle can be adjusted comparatively (duty). Accommodation of luminescence time amount (duty) is equivalent to adjusting the peak current I_p of each light emitting device equivalent. Therefore, it is possible by adjusting duty to adjust display brightness simple and free. Furthermore, an important point can enlarge I_p equivalent by setting up duty appropriately. For example, if duty is made into 1/10,

brightness equivalent as for 10 times will be obtained in I_p . If I_p is increased 10 times, channel length L of TFT can be made into $1/10$. Thus, it enables the design degree of freedom of TFT contained in a pixel by choosing duty suitably to perform increase and a practical design.

[0019]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained to a detail below. Drawing 1 expresses an example of the first operation gestalt of the image display device concerning this invention, and is a representative circuit schematic for 1 pixel. In addition, a corresponding reference number is given to the conventional pixel structure shown in drawing 10, and a corresponding part, and an understanding is made easy. Data-line Y which gives the brightness information for driving the scanning line X and Pixel PXL for this image display device choosing Pixel PXL in a predetermined scan cycle (frame) is arranged in the shape of a matrix so that it may illustrate. The pixel PXL formed in the intersection of the scanning line X and data-line Y contains retention volume Cs with TFT1 which are a light emitting device OLED and the first active element, and TFT2 which is the second active element. Brightness changes with the amounts of currents to which a light emitting device OLED is supplied. TFT1 writes the brightness information which was controlled by the scanning line X and given from data-line Y in the retention volume Cs contained in Pixel PXL. TFT2 controls the amount of currents supplied to a light emitting device OLED according to the brightness information written in Cs. The writing of the brightness information to PXL is in the condition that the scanning line X was chosen, and is performed by impressing the electrical signal (data potential V_{data}) according to brightness information to data-line Y. The brightness information written in Pixel PXL is held at retention volume Cs, also after the scanning line X is un-choosing, and a light emitting device OLED can maintain lighting by the brightness according to the held brightness information. It has the control means which switches off compulsorily at least the light emitting device OLED of each pixel PXL connected to the same scanning line X as a description matter of this invention per scanning line, and after brightness information is written in each pixel PXL, while being the 1 scan cycle in which brightness information new next is written, a light emitting device is changed into a putting-out-lights condition from a lighting condition. It is possible for a control means to control the gate potential of TFT2 by this operation gestalt with the control signal given to the gate G of TFT3 including TFT3 (the third active element) connected to the gate G of TFT2, and to switch off OLED. This control signal is given to TFT3 contained in each pixel PXL on the scanning line which corresponds through the scanning line X and the halt control line Z formed in parallel. By making TFT3 into an ON state according to a control signal, retention volume Cs discharges, V_{gs} of TFT2 is set to 0V, and the current which flows to OLED can be intercepted. Common connection of the gate G of TFT3 is made, and it can perform luminescence halt control to the halt control line Z corresponding to the scanning line X per halt control-line Z.

[0020] Drawing 2 is the circuit diagram showing the whole image-display-device configuration which arranged on the matrix PXL shown in drawing 1. The scanning lines X_1, X_2, \dots, X_N are arranged by behavior, and data-line Y is arranged by seriate so that it may illustrate. Pixel PXL is formed in the intersection of each scanning line X and data-line Y. Moreover, the halt control lines Z_1, Z_2, \dots, Z_N are formed in the scanning lines X_1, X_2, \dots, X_N and parallel. The scanning line X is connected to the scanning-line drive circuit 21. The scanning-line drive circuit 21 contains the shift register, and makes sequential selection of the scanning lines X_1, X_2, \dots, X_N within a 1 scan cycle by carrying out the sequential transfer of the perpendicular start pulse VSP 1 synchronizing with the perpendicular clock VCK. On the other hand, the halt control line Z is connected to the halt control-line drive circuit 23. This drive circuit 23 also contains the shift register, and a control signal is outputted to the halt control line Z by carrying out the sequential transfer of the perpendicular start pulse VSP 2 synchronizing with VCK. In addition, as for VSP2, delay processing only of the predetermined time is carried out by the delay circuit 24 from VSP1. It connects with the data-line drive circuit 22, and data-line Y outputs the electrical signal corresponding to brightness information to each data-line Y synchronizing with line sequential scanning of the scanning line X. In this case, the data-line drive circuit 22 performs the so-called line sequential drive, and supply an electrical signal all at once to the line of the selected pixel. Or the data-line drive circuit 22 may perform the so-called point sequential drive, and may supply an electrical signal one by one to the line of the selected pixel. Anyway, this invention includes both line sequential drive and point sequential drive.

[0021] Drawing 3 is a timing chart with which explanation of the image display device concerning the first operation gestalt of this invention shown in drawing 2 of operation is presented. First, the perpendicular start pulse VSP 1 is inputted into the scanning-line drive circuit 21 and a delay circuit 24. After the scanning-line drive circuit 21 receives the input of VSP1, synchronizing with the perpendicular clock VCK, sequential selection of the scanning lines X_1, X_2, \dots, X_N is made, and brightness information is written in Pixel PXL per scanning line. Each pixel PXL starts luminescence by the reinforcement according to the written-in brightness information. VSP1 is delayed in a delay circuit 24, and is inputted into the halt control-line drive circuit 23 as VSP2. After the halt control-line drive circuit 23 receives

VSP2, it makes sequential selection of the halt control lines Z1, Z2, --, ZN synchronizing with the perpendicular clock VCK, and luminescence stops it per scanning line.

[0022] According to the first operation gestalt shown in drawing 1 thru/or drawing 3, it is a part for the time delay set up in general by the delay circuit 24 that each pixel PXL emits light after brightness information is written in until luminescence stops with a luminescence halt control signal. If the time delay is set to τ and time amount of a 1 scan cycle (one frame) is set to T, the time rate, i.e., duty, that the pixel is emitting light will serve as τ/T in general. The time average brightness of a light emitting device changes in proportion to this duty. Therefore, adjustable setting of the screen intensity of an EL display can be carried out in the simple and broad range by operating a delay circuit 24 and changing a time delay τ .

[0023] Furthermore, it enables it to perform the increase of the design degree of freedom of a pixel circuit, and a better design that control of brightness becomes easy. In the example of a pixel design of the conventional image display device shown in drawing 10, the size of TFT2 was decided as follows.

channel width: -- $W = 5$ -micrometer channel length: -- $L = \{W / (2, I_p)\}$ and $2 = 270$ micrometers of μ -Cox-****, such sizes of TFT2 correspond, when the duty of a light emitting device is 1. On the other hand, in the image display device concerning this invention, as mentioned above, duty can be beforehand set as a desired value. For example, duty can be set to 0.1. In this case, as an example of a design by this invention, the size of TFT2 shown in drawing 1 is reducible as follows.

channel width: -- $W = 5$ -micrometer channel length: -- the parameter of $L = 270$ micrometer $\times 0.1 = 27$ -micrometer others presupposes that it is the same as that of the conventional example shown in drawing 10. In this case, although the current which flows to OLED at the time of luminescence becomes 10 times according to a formula (1), since duty is set to 0.1, the drive current in a time average becomes the same as the conventional example. With an organic EL device, since a current and brightness are usually in proportionality, the luminescence brightness of a time average becomes equivalent by the conventional example and this invention. On the other hand, in the example of a design of this invention, channel length L of TFT2 is sharply miniaturized with 1/10 of the conventional examples. Since the pulse duty factor of TFT2 in the interior of a pixel falls sharply and a large occupancy area (luminescence field) of an organic EL device can be taken as a result by this, image grace improves. Moreover, detailed-ization of a pixel also becomes realizable easily.

[0024] Drawing 4 is the whole circuitry Fig. showing an example of the second operation gestalt of the image display device concerning this invention. A corresponding reference number is given to the first operation gestalt shown in drawing 2, and a corresponding part, and an understanding is made easy. To the first operation gestalt being the image display device of monochrome, this operation gestalt is the image display device of a color, and accumulation formation of the pixel PXL to which RGB three primary colors were assigned is carried out. With this operation gestalt, while connecting each pixel PXL of red, green, and blue to the same scanning line X in common, each pixel of red, green, and blue is separately connected to the halt control lines ZR, ZG, and ZB. When separate, it enables it to switch off by this red, green, and the light emitting device contained in each blue pixel. Specifically corresponding to the pixel PXL of RGB 3 color, three halt control-line drive circuits 23R, 23G, and 23B are formed separately. Moreover, corresponding to these halt control-line drive circuits 23R, 23G, and 23B, delay circuits 24R, 24G, and 24B are formed separately, respectively. therefore, RGB -- separately, the time delay of VSP1 can be set up and VSP2R, VSP2G, and VSP2B can be supplied to the corresponding halt control-line drive circuits 23R, 23G, and 23B. A red pixel (R) is connected to the halt control line ZR controlled by halt control-line drive circuit 23R, a green pixel (G) is connected to the halt control line ZG controlled by halt control-line drive circuit 23G, and a blue pixel (B) is connected to the halt control line ZB controlled by halt control-line drive circuit 23B. According to this configuration, brightness can be adjusted for every color of RGB. Therefore, it is possible for chromaticity accommodation of a color picture indicating equipment to become easy, and to take a color-balance simply by adjusting appropriately the time delay of delay circuits 24R, 24G, and 24B. That is, it is possible to observe a screen, and to weaken a redness component by adjusting the time delay of delay circuit 24R, and making duty corresponding to red small relatively, when a redness component is too strong.

[0025] Drawing 5 is the representative circuit schematic for 1 pixel showing an example of the third operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the first operation gestalt shown in drawing 1, and a corresponding part, and makes an understanding easy. This operation gestalt can intercept the current which flows to a light emitting device OLED according to the control signal given to TFT3 including TFT3 (the third active element) connected with the light emitting device OLED at the serial. A control signal is given to the gate G of TFT3 contained in each pixel PXL on the same scanning line through the scanning line X and the halt control line Z formed in parallel. With this operation gestalt, TFT3 is inserted between touch-down potential and TFT2, and the current which flows to OLED by control of the gate potential of TFT3 can be turned on / turned off. In addition, it is

also possible to insert TFT3 between TFT2 and OLED or between OLED and Vdd.

[0026] Drawing 6 is the representative circuit schematic for 1 pixel showing an example of the fourth operation gestalt of the image display device concerning this invention. A corresponding reference number is given to the conventional example shown in drawing 10, and a corresponding part, and an understanding is made easy. With this operation gestalt, a light emitting device OLED consists of a one terminal pair network component which has rectification, one terminal (cathode K) is connected to TFT2, and the other-end child (anode A) is connected to the halt control line Z. At each pixel on the same scanning line, common connection of the anode A of a one terminal pair network component is made at the halt control line Z, and it dissociates electrically between the different scanning lines. In this case, the potential of the other-end child (anode A) by whom common connection of the one terminal pair network component was made -- the halt control line Z -- controlling -- every -- OLED is switched off. However, the anode A of OLED is not connected to Vdd of fixed potential like before, but the potential is controlled from the exterior through the halt control line Z. Although the current controlled by TFT2 flows anode potential to sufficiently high value, then OLED, since OLED has rectification with a one terminal pair network component, it can turn off the current which flows to OLED by making anode potential into sufficiently low potential (for example, touch-down potential).

[0027] Drawing 7 is a timing chart which shows the example of control of the fourth operation gestalt shown in drawing 6. The 1 scan cycle (one frame) is expressed with T. In the write-in period (RT) located in the head of the 1 scan cycle T, brightness information over all pixels is written in by line sequential. That is, in this example, brightness information is written in the high speed at all pixels using a part of 1 scan cycle. After writing is completed, the halt control lines Z are controlled all at once, and OLED contained in each pixel is turned on. Thereby, OLED of each pixel starts luminescence according to the written-in brightness information, respectively. Progress of the after predetermined time delay τ drops the anode A of all OLED(s) to touch-down potential through all the halt control lines Z. Thereby, luminescence becomes off. The above control can adjust duty τ/T in all pixel units. In addition, this invention is not restricted to this and you may make it control ON/OFF of each pixel per scanning line at least. As mentioned above, a lighting [of the light emitting device contained in each pixel] and putting-out-lights time is controllable by this example of control per a screen unit or scanning line within the 1 more scan cycle by which brightness information was written in each pixel.

[0028] Drawing 8 is the whole circuitry Fig. showing an example of the fifth operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the conventional example shown in drawing 11, and a corresponding part, and makes an understanding easy. This operation gestalt is performing duty control of each pixel PXL using the scanning line X1 thru/or XN, without forming the special halt control line unlike a previous operation gestalt. For this reason, control circuit 23' is prepared independently [the scanning-line drive circuit 21]. Each output terminal of control circuit 23' is connected to one corresponding input terminal of each AND gate circuit 28. The output terminal of each AND gate circuit 28 is connected to each scanning lines X1, X2, --, XN through one input terminal of the OR gate circuit 29 of the next step. VCK is supplied to the other-end child of each AND gate circuit 28. In addition, each output terminal of the scanning-line drive circuit 21 is connected to each scanning lines X1, X2, --, XN through the corresponding input terminal of another side of each OR gate circuit 29. Moreover, VSP1 turns into VSP2 through a delay circuit 24 like a previous operation gestalt, and is supplied to control circuit 23'. On the other hand, each data-line Y is connected to the data-line drive circuit 22 through TFT26 of a P channel mold. VCK is supplied to the gate of TFT26. Moreover, the potential of each data-line Y is controllable also by TFT27 of N channel mold. VCK is supplied also to the gate of TFT27. Thus, although the circumference circuitry of this image display device differs from the conventional example shown in drawing 11, the circuitry of each pixel PXL is the same as the conventional pixel circuitry shown in drawing 10. By this configuration, after brightness information is written in each pixel PXL, while being the 1 scan cycle in which brightness information new next is written, control circuit 23' can write in the information which chooses the scanning line X again and expresses brightness 0 to each pixel PXL from data-line Y, and can switch off the light emitting device OLED of each pixel PXL.

[0029] Drawing 9 is a timing chart with which explanation of the fifth operation gestalt shown in drawing 8 of operation is presented. The perpendicular start pulse VSP 1 is inputted into the scanning-line drive circuit 21 and a delay circuit 24 so that it may illustrate. After the scanning-line drive circuit 21 accepts VSP1, it makes sequential selection of the scanning lines X1, X2, --, XN synchronizing with the perpendicular clock VCK, and writes brightness information in each pixel PXL per scanning line. Each pixel starts luminescence by the reinforcement according to the written-in brightness information. However, with this operation gestalt, by having formed TFT 26 and 27, each data-line Y becomes the potential (this example touch-down potential) which is equivalent to brightness 0 in the period of $VCK=H$ (high-level), and original brightness information is given in the period of $VCK=L$ (low level). This relation gives L and H to the wave of VCK of drawing 9, gives hatching to the wave of the data line, and has expressed it to it typically.

After VSP1 is delayed in a delay circuit 24, it is inputted into control circuit 23' as VSP2. The output is inputted into the AND gate circuit 28, although control circuit 23' operates synchronizing with the perpendicular clock VCK after accepting VSP2. since VCK is inputted into coincidence in each AND gate circuit 28 -- the output of control circuit 23' - H (high-level) -- and the scanning line X is chosen at the time of VCK=H (high-level). Since the potential with which the period of VCK=H is equivalent to brightness 0 at each data-line Y is given as mentioned above, luminescence stops the pixel connected to the scanning line X chosen by control circuit 23' using the information equivalent to brightness 0.

[0030] Drawing 14 is the representative circuit schematic for 1 pixel showing an example of the sixth operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the first operation gestalt shown in drawing 1, and a corresponding part, and makes an understanding easy. With each previous operation gestalt, although there are many things with the need of adding a transistor in order to switch off a pixel, the additional transistor of this operation gestalt is unnecessary, and it has more practical composition. The other-end child of the capacitive element Cs connected to the gate G of the transistor TFT2 which controls the amount of currents supplied to a light emitting device OLED is connected to the luminescence halt control line Z so that it may illustrate. The potential of the luminescence stop line Z is lowered after write-in termination (example of this drawing). For example, the capacity of a capacitive element Cs serves as change of the gate potential of the potential change 2 of the luminescence halt control line Z, i.e., TFT, when sufficiently large compared with the gate capacitance of TFT2 etc. Therefore, when maximum of the gate potential of TFT2 at the time of writing is set to V_{gmax} , by lowering the potential of the luminescence halt control line Z more than $V_{gmax} - V_{th}$ from the time of writing, gate potential of TFT2 can be made below into V_{th} , therefore a light emitting device OLED is switched off. It is desirable to control by the big amplitude to a slight degree in consideration of the gate capacitance of TFT2 etc. in fact.

[0031] Drawing 15 is a timing chart with which explanation of the sixth operation gestalt shown in drawing 14 of operation is presented. The halt control line is made in general into a high level with scanning-line selection at coincidence, and the period when a high level after write-in termination is maintained, and a light emitting device will be in a luminescence condition by the brightness according to the written-in brightness information so that it may illustrate. If the halt control line is made into a low before writing in new data with the following frame, a light emitting device will be switched off.

[0032] By the way, in CRT, the display image serves as a display principle of the maintenance mold which continues displaying the image between one frame on the display of a active-matrix mold to brightness declining by msec order. When performing a movie display for this reason, the pixel which met the profile of an animation shows the image, until just before a frame switches, and this senses it as if the image was conjointly displayed as the after-image effectiveness of human being's eyes there also with the following frame. This is the cause of fundamental that the image quality of the movie display in a active-matrix mold display becomes low as compared with CRT. As this solution, the drive approach concerning this invention is effective, and the improvement of the quality of an animation can be aimed at by introducing the technique of severing the after-image which switches off a pixel compulsorily and is felt by human being's eyes. In the display of a active-matrix mold, while displaying an image in the first half of one frame, specifically, that method of switching off an image which CRT brightness decreases is adopted like the second half of one frame. For the nature improvement of an animation, the duty of per frame, lighting, and putting out lights is set up to about 50%. Furthermore, for the high nature improvement of an animation, it is good to set up the duty of per frame, lighting, and putting out lights to 25% or less.

[0033] [Effect of the Invention] Since luminescence of a pixel can be stopped according to this invention before the writing of the following frame is performed after brightness information is written in each pixel and luminescence begins as explained above, the luminescence time amount within one frame can be changed comparatively (duty), and it is possible for this to adjust the display brightness of a time average simple. Furthermore, since the degree of freedom which sets up suitably the amount of currents which flows to a light emitting device at the time of luminescence arises keeping the display brightness of a time average the same by the ability setting up duty freely, a degree of freedom produces an important thing in the design of the active element which controls the amount of currents which flows to a light emitting device. Consequently, it becomes possible to design the image display device which can offer a more nearly high-definition image, and the image display device of smaller pixel size.

[Translation done.]

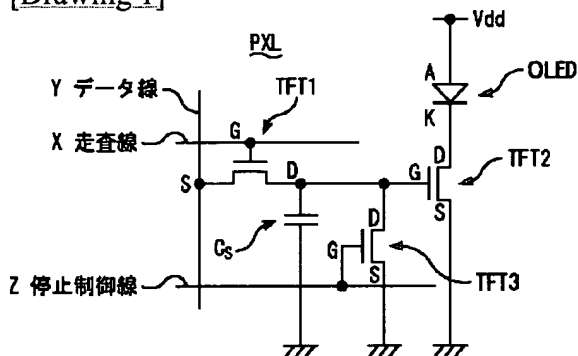
* NOTICES *

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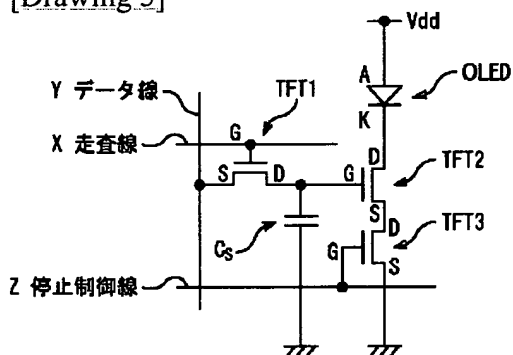
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DRAWINGS

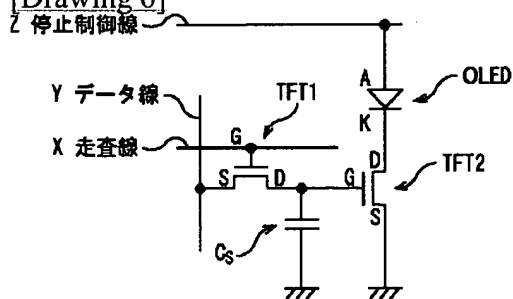
[Drawing 1]



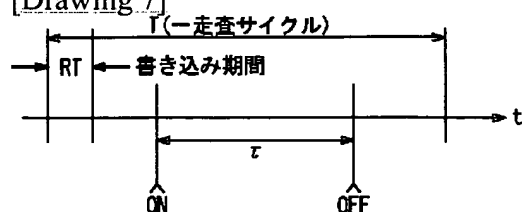
[Drawing 5]



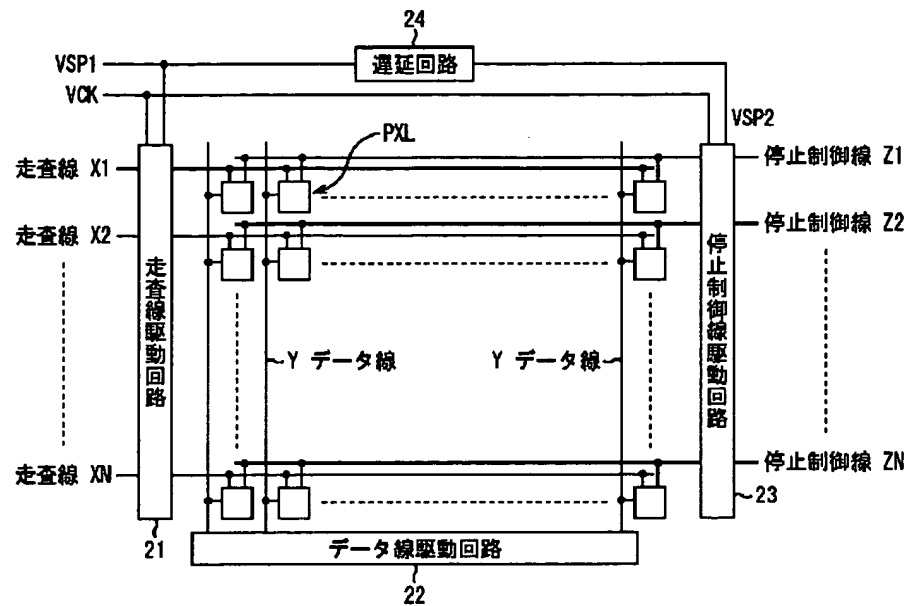
[Drawing 6]



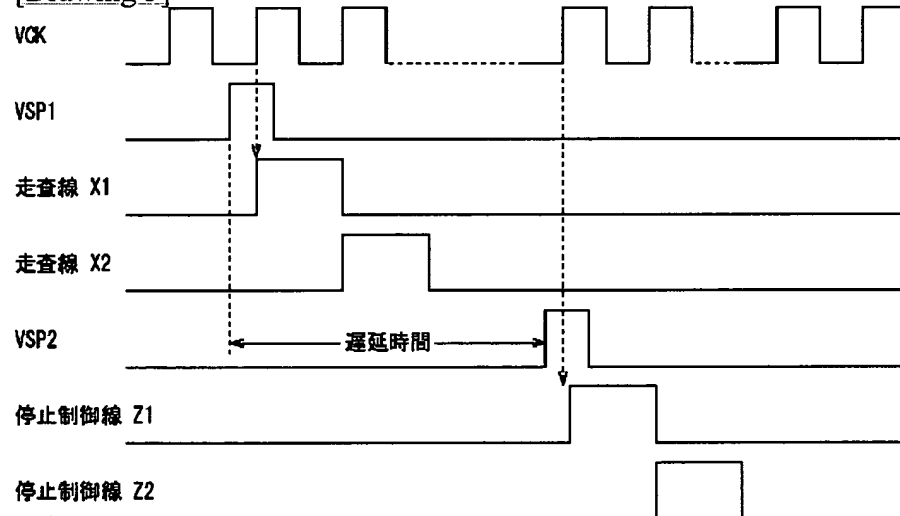
[Drawing 7]



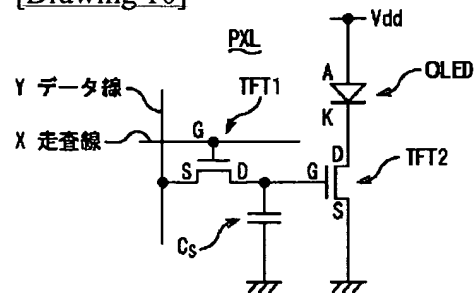
[Drawing 2]



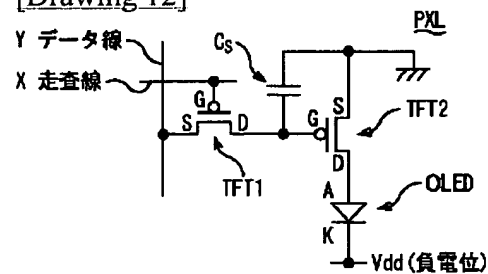
[Drawing 3]



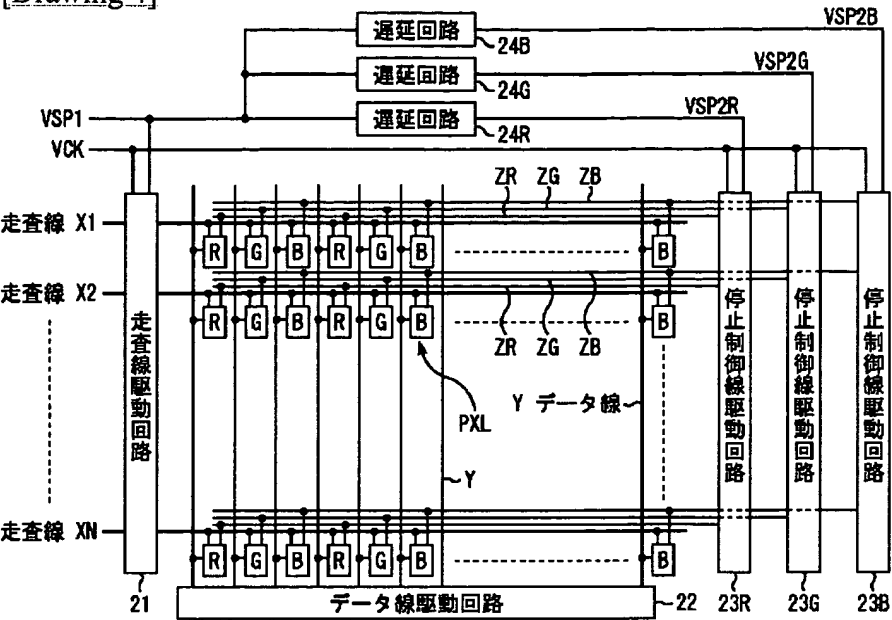
[Drawing 10]



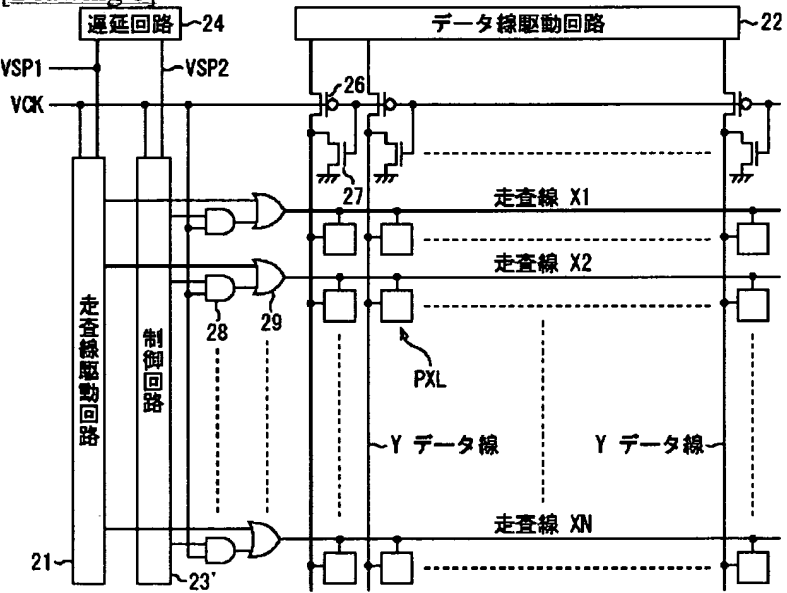
[Drawing 12]



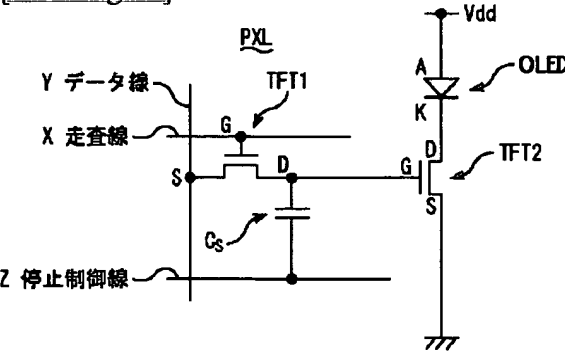
[Drawing 4]



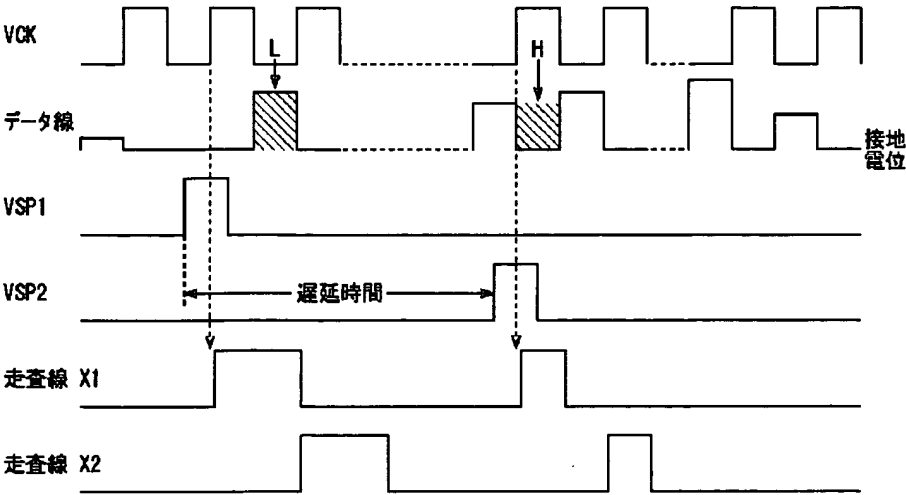
[Drawing 8]



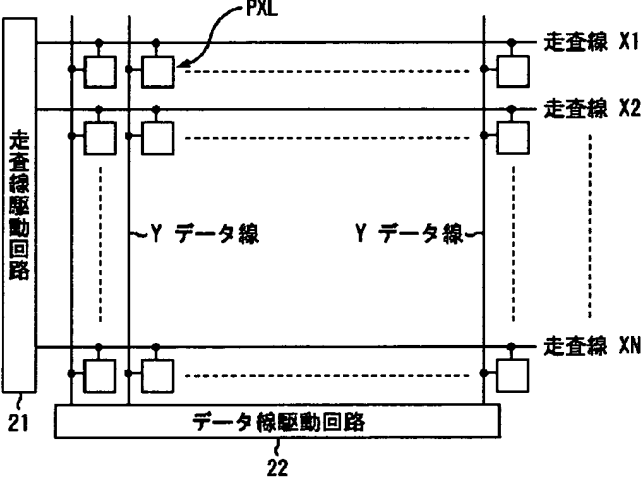
[Drawing 14]



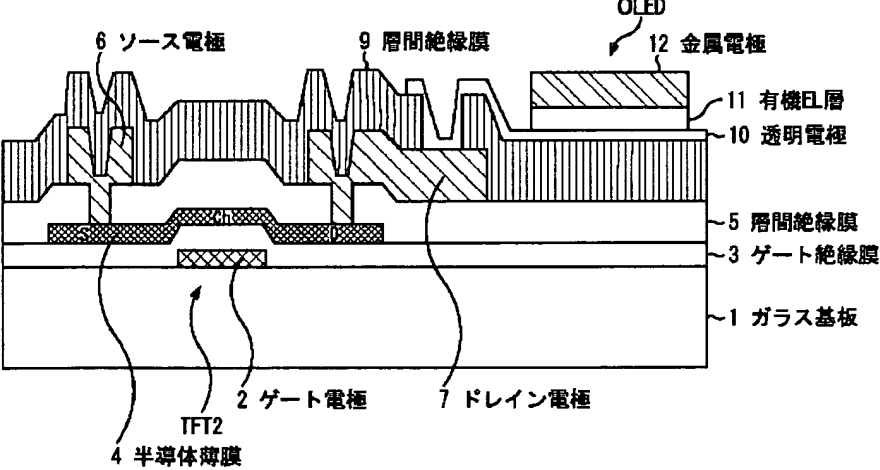
[Drawing 9]



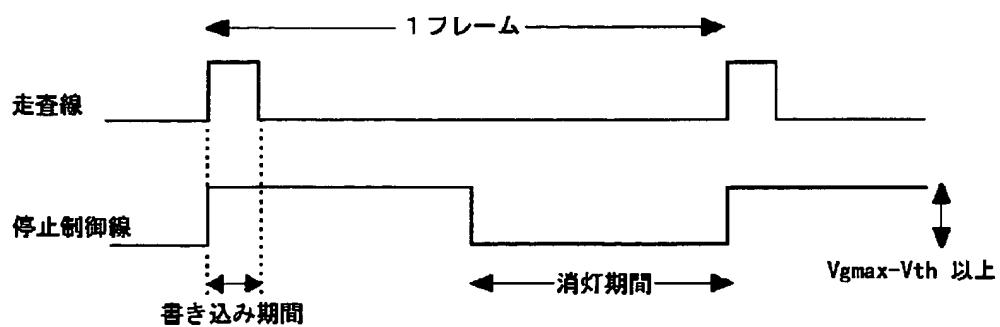
[Drawing 11]



[Drawing 13]



[Drawing 15]



[Translation done.]

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CORRECTION OR AMENDMENT

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 [Section partition] The 2nd partition of the 6th section
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3/20 624
 642

[FI]

G09G 3/30 J
 K
 3/20 624 B
 642 Z
 642 L

[Procedure revision]
 [Filing Date] May 10, Heisei 14 (2002. 5.10)
 [Procedure amendment 1]
 [Document to be Amended] Specification
 [Item(s) to be Amended] Whole sentence
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Document Name] Specification
 [Title of the Invention] Image display device
 [Claim(s)]

[Claim 1] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix, Each pixel contains the first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, and the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare *****
 The writing of the brightness information to each pixel is in the condition that the scanning line was chosen, and is performed by impressing the electrical signal according to brightness information to the data line,
 In the image display device which can maintain lighting by the brightness according to the brightness information by which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held,

The image display device characterized by controlling the time average brightness of this light emitting device by changing a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after having the control means which switches off compulsorily at least the light emitting device of each pixel connected to the same scanning line per scanning line and writing brightness information in each pixel.

[Claim 2] Said control means is an image display device according to claim 1 characterized by the ability to adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 3] The gate potential of this second active element is controlled by the control signal given to this third active element including the third active element connected to the gate of this second active element that consists of an insulated gate field effect transistor, and said control means can switch off this light emitting device.

This control signal is an image display device according to claim 1 characterized by being given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel.

[Claim 4] Said control means can intercept the current which flows to this light emitting device according to the control signal given to this third active element including the third active element connected with this light emitting device at the serial.

This control signal is an image display device according to claim 1 characterized by being given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel.

[Claim 5] Each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, and common connection of the other-end child is made in each pixel on the same scanning line, and it dissociates electrically between the scanning lines, Said control means is an image display device according to claim 1 characterized by controlling the potential of the other-end child by whom common connection of the two terminal each component was made, and switching off a two terminal each component.

[Claim 6] Said control means is an image display device according to claim 1 characterized by writing in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switching off the light emitting device of each pixel while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 7] Each pixel contains the capacitative element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element which controls the amount of currents which flows to this light emitting device,

Said control means is an image display device according to claim 1 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off this light emitting device by controlling the potential of the other end of this capacitative element.

[Claim 8] Said control means is an image display device according to claim 1 characterized by controlling at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time per scanning line within the back 1 scan cycle by which brightness information was written in each pixel.

[Claim 9] It is the image display device according to claim 1 characterized by said control means switching off the light emitting device contained in each pixel of red, green, and blue when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 10] Said light emitting device is an image display device according to claim 1 characterized by being an organic electroluminescent element.

[Claim 11] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix,

Each pixel is the drive approach of the image display device containing the first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, and the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare *****

The writing of the brightness information to each pixel is in the condition that the scanning line was chosen, and is performed by impressing the electrical signal according to brightness information to the data line,

The brightness information written in each pixel is held at each pixel, even after the scanning line is un-choosing, and

the light emitting device of each pixel maintains lighting by the brightness according to the held brightness information, The drive approach of the image display device characterized by controlling the time average brightness of this light emitting device by changing a light emitting device into a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after being able to switch off compulsorily at least the light emitting device of each pixel connected to the same scanning line per scanning line and writing brightness information in each pixel.

[Claim 12] The drive approach of the image display device according to claim 11 characterized by the ability to adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 13] It is possible to connect the third active element to the gate of this second active element that consists of an insulated gate field effect transistor, to control the gate potential of this second active element by the control signal given to this third active element, and to switch off this light emitting device,

This control signal is the drive approach of the image display device according to claim 11 characterized by giving the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel.

[Claim 14] It is possible to intercept the current which flows to this light emitting device according to the control signal which connects the third active element to this light emitting device and a serial, and is given to this third active element,

This control signal is the drive approach of the image display device according to claim 11 characterized by giving the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel.

[Claim 15] Each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, and common connection of the other-end child is made in each pixel on the same scanning line, and it dissociates electrically between the scanning lines,

The drive approach of the image display device according to claim 11 characterized by controlling the potential of the other-end child by whom common connection of the two terminal each component was made, and switching off a two terminal each component.

[Claim 16] The drive approach of the image display device according to claim 11 characterized by writing in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switching off the light emitting device of each pixel while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel.

[Claim 17] Each pixel contains the capacitative element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element which controls the amount of currents which flows to this light emitting device,

The drive approach of the image display device according to claim 11 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element by controlling the potential of the other end of this capacitative element, and switching off this light emitting device.

[Claim 18] The drive approach of the image display device according to claim 11 characterized by controlling at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time per scanning line within the back 1 scan cycle by which brightness information was written in each pixel.

[Claim 19] The drive approach of the image display device according to claim 11 characterized by switching off red, green, and the light emitting device contained in each blue pixel when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 20] Said light emitting device is the drive approach of the image display device according to claim 11 characterized by using an organic electroluminescent element.

[Claim 21] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix,

Each pixel contains the first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, and the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare *****

The writing of the brightness information to each pixel is in the condition that the scanning line was chosen, and is performed by impressing the electrical signal according to brightness information to the data line,

In the image display device which can maintain lighting by the brightness according to the brightness information by

which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held,

After having the control means which switches off compulsorily the light emitting device of each pixel connected to each scanning line and writing brightness information in each pixel, while being the 1 scan cycle in which brightness information new next is written, it is the image display device which controls the time average brightness of this light emitting device by changing a light emitting device into a putting-out-lights condition from a lighting condition, It is the image display device characterized by said control means switching off the light emitting device contained in each pixel of red, green, and blue when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 22] The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix,

Each pixel is the drive approach of the image display device containing the first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, and the second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** ,

The writing of the brightness information to each pixel is in the condition that the scanning line was chosen, and is performed by impressing the electrical signal according to brightness information to the data line,

The brightness information written in each pixel is held at each pixel, even after the scanning line is un-choosing, and the light emitting device of each pixel maintains lighting by the brightness according to the held brightness information, After being able to switch off compulsorily the light emitting device of each pixel connected to each scanning line and writing brightness information in each pixel, while being the 1 scan cycle in which brightness information new next is written, it is the drive approach which controls the time average brightness of this light emitting device by changing a light emitting device into a putting-out-lights condition from a lighting condition,

The drive approach of the image display device characterized by switching off red, green, and the light emitting device contained in each blue pixel when separate while connecting each pixel of red, green, and blue to the same scanning line in common.

[Claim 23] In the image display device which turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in after the first brightness information is written in a pixel,

The scanning line which chooses each pixel in a predetermined scan cycle,

The data line which gives the brightness information for being formed in the direction which intersects perpendicularly with this scanning line, and turning on the above-mentioned pixel,

The first active element which is controlled by the above-mentioned scanning line and incorporates the above-mentioned brightness information,

It has the second active element which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel,

The control means which controls the time average brightness of this light emitting device by changing the above-mentioned pixel into a putting-out-lights condition from a lighting condition within a top Norikazu scan cycle period

The image display device characterized by ****(ing).

[Claim 24] The above-mentioned control means is an image display device according to claim 23 characterized by adjustable being possible in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out] within the above-mentioned 1 scan cycle period.

[Claim 25] The second active element of the above is an insulated gate field effect transistor,

The above-mentioned control means has the third active element connected to the gate of this insulated gate field effect transistor,

This third active element is an image display device according to claim 23 characterized by being controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 26] The above-mentioned control means has the third active element prepared in the second active element of the above at the serial,

This third active element is an image display device according to claim 23 characterized by being controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 27] The above-mentioned pixel contains a light emitting device,

The above-mentioned light emitting device has the first and the second terminal, and while the first terminal of the

above is connected to the second active element of the above, the second terminal of the above is connected to predetermined reference potential,

The above-mentioned control means is an image display device according to claim 23 characterized by making the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential.

[Claim 28] The above-mentioned control means is an image display device according to claim 23 characterized by switching off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen.

[Claim 29] Each pixel contains the capacitive element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes this second active element,

The above-mentioned control means is an image display device according to claim 23 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off a pixel by controlling the potential of the other end of this capacitive element.

[Claim 30] The above-mentioned control means is an image display device according to claim 23 characterized by switching off the above-mentioned pixel for every above-mentioned scanning line.

[Claim 31] The above-mentioned pixel has the light emitting device of blue, green, and red,

The above-mentioned control means is this blue, green, and an image display device according to claim 23 characterized by the ability to switch off a red light emitting device by different time amount.

[Claim 32] The second active element of the above converts brightness information into the current used for the drive of a pixel,

Each pixel is an image display device according to claim 23 characterized by having a light emitting device using the organic substance which emits light according to a current.

[Claim 33] It has the scanning-line drive circuit where the perpendicular clock for making sequential selection of the above-mentioned scanning line is inputted,

The above-mentioned control means has the control circuit which chooses the control line which the predetermined perpendicular clock which carried out period delay was inputted, and formed the above-mentioned perpendicular clock in the above-mentioned scanning line or this, and parallel,

While sequential selection of the above-mentioned scanning line is made by the above-mentioned scanning-line drive circuit synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel,

The image display device according to claim 23 characterized by switching off this pixel through the above-mentioned control line within the above-mentioned 1 scan period synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] after this lighting in this control circuit.

[Claim 34] It has the data-line drive circuit which gives brightness information to the above-mentioned data line,

While the output of the above-mentioned scanning-line drive circuit is connected to one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line,

The output of the above-mentioned control circuit is connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit,

The image display device according to claim 33 characterized by inputting the above-mentioned perpendicular clock into the input terminal of another side of this AND circuit.

[Claim 35] In the drive approach of the image display device which turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in after the first brightness information is written in a pixel,

The procedure which chooses each pixel in a predetermined scan cycle through the scanning line,

The procedure of giving the brightness information for turning on the above-mentioned pixel through the data line formed in the direction which intersects perpendicularly with this scanning line,

The procedure of incorporating the above-mentioned brightness information to a pixel by the first active element controlled by the above-mentioned scanning line,

The procedure which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel by the second active element,

The drive approach of the image display device characterized by performing the control procedure which controls the time average brightness of this light emitting device by changing the above-mentioned pixel into a putting-out-lights condition from a lighting condition within a top Norikazu scan cycle period.

[Claim 36] The above-mentioned control procedure is the drive approach of the image display device according to claim

35 characterized by adjustable being possible in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out] within the above-mentioned 1 scan cycle period.

[Claim 37] The insulated gate field effect transistor is used for the second active element of the above, The above-mentioned control procedure is performed using the third active element connected to the gate of this insulated gate field effect transistor,

This third active element is the drive approach of the image display device according to claim 35 characterized by controlling by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 38] The above-mentioned control procedure uses for the second active element of the above the third active element prepared in the serial,

This third active element is the drive approach of the image display device according to claim 35 characterized by being controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel.

[Claim 39] As for the above-mentioned light emitting device, the above-mentioned pixel has the first and the second terminal including a light emitting device, and while the first terminal of the above is connected to the second active element of the above, the second terminal of the above is connected to predetermined reference potential,

The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by making the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential.

[Claim 40] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by switching off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen.

[Claim 41] Each pixel contains the capacitative element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes this second active element,

The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by controlling the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switching off a pixel by controlling the potential of the other end of this capacitative element.

[Claim 42] The above-mentioned control procedure is the drive approach of the image display device according to claim 35 characterized by switching off the above-mentioned pixel for every above-mentioned scanning line.

[Claim 43] The above-mentioned pixel has the light emitting device of blue, green, and red,

The above-mentioned control procedure is this blue, green, and the drive approach of the image display device according to claim 35 characterized by the ability to switch off a red light emitting device by different time amount.

[Claim 44] The second active element of the above converts brightness information into the current used for the drive of a pixel,

Each pixel is the drive approach of the image display device according to claim 35 characterized by having a light emitting device using the organic substance which emits light according to a current.

[Claim 45] The scanning-line drive procedure which inputs the perpendicular clock for making sequential selection of the above-mentioned scanning line,

The perpendicular clock with which predetermined carried out period delay of the above-mentioned perpendicular clock is inputted, and the control procedure which chooses the above-mentioned scanning line or the control line formed in parallel as having come is performed,

While sequential selection of the above-mentioned scanning line is made by the above-mentioned scanning-line drive procedure synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel, The drive approach of the image display device according to claim 35 characterized by switching off this pixel through the above-mentioned scanning line or the control line within the above-mentioned 1 scan period synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] with this control procedure after this lighting.

[Claim 46] The data-line drive procedure of giving brightness information to the above-mentioned data line is included, While the output of the above-mentioned scanning-line drive procedure is connected to one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line,

The output of the above-mentioned control procedure is connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit,

The drive approach of the image display device according to claim 45 characterized by inputting the above-mentioned perpendicular clock into the input terminal of another side of this AND circuit.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image display device equipped with the pixel by which brightness is controlled by the signal. For example, it is related with the image display device equipped with the light emitting device by which brightness is controlled by currents, such as an organic electroluminescence (EL) component, for every pixel. It is related with the so-called active-matrix type with which the amount of currents supplied to a light emitting device is controlled by active elements, such as an insulated gate field effect transistor prepared in each pixel, in more detail of image display device.

[0002]

[Description of the Prior Art] An image is displayed by arranging many pixels in in the shape of a matrix, and generally, controlling optical reinforcement by the image display device of a active-matrix mold for every pixel according to the given brightness information. When liquid crystal is used as electrooptic material, the permeability of a pixel changes according to the electrical potential difference written in each pixel. It is the same as that of the case where fundamental actuation uses liquid crystal also with the image display device of the active-matrix mold using the organic electroluminescence ingredient as electrooptic material. However, unlike a liquid crystal display, an organic electroluminescence display is the so-called spontaneous light type which has a light emitting device in each pixel, and has an advantage, like a back light with the high visibility of an image has needlessness and a quick speed of response compared with a liquid crystal display. The brightness of each light emitting device is controlled by the amount of currents. That is, in that a light emitting device is a current drive mold or a current control mold, a liquid crystal display etc. is large and it differs.

[0003] A passive matrix and an active matrix are possible also for an organic electroluminescence display as the drive method like a liquid crystal display. Although structure of the former is simple, since implementation of a large-sized and high definition display is difficult, development of an active matrix is performed briskly. An active matrix is controlled by the active element (generally it may call the thin film transistor which is a kind of an insulated gate field effect transistor, and Following TFT) which prepared the current which flows to the light emitting device prepared in each pixel in the interior of a pixel. The organic electroluminescence display of this active matrix is indicated by JP,8-234683,A, and shows the equal circuit for 1 pixel to drawing 10. Pixel PXL consists of a light emitting device OLED, the first thin film transistor TFT1, the second thin film transistor TFT2, and retention volume Cs. A light emitting device is an organic electroluminescence (EL) component. Since an organic EL device has a rectifying action in many cases, it may be called OLED (organic light emitting diode), and uses the notation of diode as a light emitting device OLED by a diagram. However, a light emitting device is not necessarily restricted to OLED, and brightness should just be controlled by the amount of currents which flows for a component. Moreover, a rectifying action is not necessarily required of a light emitting device. In the example of illustration, the source S of TFT2 is made into a reference potential (touch-down potential), and while the anode A of a light emitting device OLED (anode plate) is connected to Vdd (power-source potential), Cathode K (cathode) is connected to the drain D of TFT2. On the other hand, the gate G of TFT1 is connected to the scanning line X, Source S is connected to data-line Y, and Drain D is connected to the gate G of retention volume Cs and TFT2.

[0004] In order to operate PXL, first, the scanning line X is made into a selection condition, if the data potential Vdata which expresses brightness information to data-line Y is impressed, TFT1 flows, retention volume Cs charges or discharges, and the gate potential of TFT2 is in agreement with the data potential Vdata. If the scanning line X is made into the condition of not choosing, TFT1 becomes off, and although TFT2 is electrically separated from data-line Y, the gate potential of TFT2 will be held with retention volume Cs at stability. The current which flows to a light emitting device OLED through TFT2 serves as a value according to the gate / electrical potential difference Vgs between the sources of TFT2, and a light emitting device OLED continues emitting light by the brightness according to the amount of currents supplied from TFT2.

[0005] On these specifications, actuation of choosing the scanning line X and telling the potential of data-line Y to the interior of a pixel is called "writing" below. Now, when the current which flows between the drain/source of TFT2 is set to Ids, this is the drive current which flows to OLED. Ids is expressed with the following formulas when TFT2 shall operate in a saturation region.

$$I_{ds} = (1/2) \cdot \mu \cdot C_{ox} \cdot (W/L) \cdot (V_{gs} - V_{th})^2$$

$$= 1/2 \cdot \mu \cdot C_{ox} \cdot (W/L) \cdot (V_{data} - V_{th})^2 \quad (1)$$

Cox is the gate capacitance of the unit area neighborhood, and is given by the following formulas here.

$$C_{ox} = \epsilon_0 \text{ and } \epsilon_{nr} / d \quad (2)$$

Vth shows the threshold of TFT2 among a formula (1) and (2), mu shows the mobility of a carrier, W shows channel width, L shows channel length, epsilon 0 shows the dielectric constant of vacuum, epsilon nr shows the specific inductive

capacity of gate dielectric film, and d is the thickness of gate dielectric film.

[0006] According to the formula (1), I_{ds} can be controlled by the potential V_{data} written in Pixel PXL, and the brightness of a light emitting device OLED can be controlled by it as a result. Here, the reason for operating TFT2 in a saturation region is as follows. That is, in order to control I_{ds} only by V_{gs} in a saturation region and not to be dependent on a drain / electrical potential difference V_{ds} between the sources, even if it changes V_{ds} by property dispersion of OLED, it is because the current I_{ds} of the specified quantity can be passed to OLED.

[0007] As mentioned above, once it writes in V_{data} , by the circuitry of the pixel PXL shown in drawing 10, OLED will continue luminescence by fixed brightness between 1 scan cycles (one frame) until it is rewritten next. If a majority of such pixels PXL are arranged in the shape of a matrix like drawing 11, a active-matrix mold image display device can be constituted. As shown in drawing 11, the scanning line X1 for the conventional image display device to choose Pixel PXL in a predetermined scan cycle (for example, frame period according to the NTSC standard) thru/or XN, and data-line Y that gives the brightness information (data potential V_{data}) for driving Pixel PXL are arranged in the shape of a matrix. While the scanning line X1 thru/or XN are connected to the scanning-line drive circuit 21, data-line Y is connected to the data-line drive circuit 22. A desired image can be displayed by repeating the writing of data-line Y to V_{data} by the data-line drive circuit 22, making sequential selection of the scanning line X1 thru/or the XN by the scanning-line drive circuit 21. With the image display device of a passive-matrix mold, with the active-matrix mold image display device shown in drawing 11 to emitting light only at the moment of being chosen, in order that the light emitting device of each pixel PXL may continue luminescence also even for after write-in termination, the light emitting devices contained in each pixel PXL are points -- compared with a passive-matrix mold, the peak brightness (peak current) of a light emitting device can be lowered -- and become advantageous on a high definition, especially large-sized display.

[0008] Drawing 12 is the representative circuit schematic showing other examples of the conventional pixel structure, gives a corresponding reference number to the previous conventional example shown in drawing 10, and a corresponding part, and makes an understanding easy. In this conventional example, the field-effect transistor of a P channel mold is used to the previous conventional example having used the field-effect transistor of an N channel mold as TFT1 and TFT2. Therefore, contrary to the circuitry of drawing 10, the cathode K of OLED connected with V_{dd} of negative potential, and Anode A has connected with the drain D of TFT2.

[0009] Drawing 13 expresses typically the cross-section structure of the pixel PXL shown in drawing 12. However, in order to make illustration easy, only TFT2 is expressed as OLED. OLED piles up a transparent electrode 10, the organic electroluminescence layer 11, and a metal electrode 12 in order. It has dissociated for every pixel, and a transparent electrode 10 functions as an anode A of OLED, for example, consists of transparence electric conduction film, such as ITO. Common connection of the metal electrode 12 is made between pixels, and it functions as a cathode K of OLED. That is, common connection of the metal electrode 12 is made at the predetermined power-source potential V_{dd} . The organic electroluminescence layer 11 serves as bipolar membrane which piled up for example, the electron hole transportation layer and the electronic transportation layer. For example, Diamyne is vapor-deposited as an electron hole transportation layer on the transparent electrode 10 which functions as an anode A (hole-injection electrode), Alq3 is vapor-deposited as an electronic transportation layer on it, and the metal electrode 12 which functions as a cathode K (electron injection electrode) on it further is formed. In addition, Alq3 is 8-hydroxy. quinoline aluminum is expressed. OLED which has such a laminated structure is only an example. If the electrical potential difference (about 10V) of the forward direction is impressed between the anode/cathode of OLED which has this configuration, impregnation of carriers, such as an electron and an electron hole, will take place, and luminescence will be observed. Actuation of OLED is considered to be luminescence by the exciton formed from the electron hole poured in from the electron hole transportation layer, and the electron poured in from the electronic transportation layer.

[0010] On the other hand, TFT2 consists of the gate electrode 2 formed on the substrate 1 which consists of glass etc., gate dielectric film 3 put on that top face, and a semi-conductor thin film 4 piled up above the gate electrode 2 through this gate dielectric film 3. This semi-conductor thin film 4 consists for example, of a polycrystalline silicon thin film. TFT2 is equipped with Source S, Channel Ch, and Drain D used as the path of the current supplied to OLED. Channel Ch is exactly located in right above [of the gate electrode 2]. TFT2 of this bottom gate structure is covered with the interlayer insulation film 5, and the source electrode 6 and the drain electrode 7 are formed on it. On these, OLED mentioned above through another interlayer insulation film 9 is formed.

[0011]

[Problem(s) to be Solved by the Invention] The first technical problem which should be solved when the EL display of the active-matrix mold mentioned above is constituted has the small design degree of freedom of TFT2 which is the active element which controls the amount of currents which flows to OLED, and the practical design doubled with the

pixel dimension depending on the case becomes difficult. Moreover, the second technical problem which should be solved is that it is difficult to adjust the display brightness of the whole screen free. It explains mentioning a design parameter concrete about the conventional example which showed these technical problems to drawing 10 thru/or 13. 1000 and a pixel dimension in the typical example of a design $S=200\text{micrometer}\times 200\text{micrometer}$, [a screen size] [the number of 20cmx20cm and lines (scanning-line number)] [the number of 1000 and trains (number of the data line)] $B_p=200\text{ cd/m}^2$ and the luminescence efficiency of element $E=10\text{ cd/A}$, [peak brightness] $\epsilon=3.9$ and carrier mobility $\mu=100\text{cm}^2/\text{V}\cdot\text{s}$, [the thickness of the gate dielectric film of TFT2] [the specific inductive capacity of $d=100\text{nm}$ and gate dielectric film] The peak current per pixel is [the peak value of $I_p=B_p/E_x S=0.8\text{microA}$ and $|V_{gs}-V_{th}|$ (driver voltage)] $V_{gs}-V_{th}=5\text{V}$. In order to supply the peak current I_p in such an example of a design, as an example of a design of TFT2, it is as follows from the formula (1) mentioned above and (2).

Channel width: $W=5\text{ micrometers}$

Channel length: $L=\{W/(2, I_p)\}$ and $2=270\text{ micrometers}$ of $\mu\text{-Cox-****}$

(3)

[0012] I hear that channel length L given by the formula (3) is the dimension which is equal to pixel size ($S=200\text{micrometer}\times 200\text{micrometer}$), or exceeds this, and all that matters first here has it. As shown in a formula (3), the peak current I_p is in inverse proportion to channel length L . In the above-mentioned example, in order to suppress the peak current I_p about [required for actuation / sufficient / 0.8micro] to A , channel length L must be lengthened to 270 micrometers. Now, since the occupancy area of TFT2 in a pixel becomes large and a result which narrows a luminescence field is brought, it is not only desirable, but detailed-ization of a pixel becomes difficult. When the parameter of the brightness (peak current) and the semi-conductor process that an essential problem is required etc. is given, I hear that there are not most design degrees of freedom of TFT2, and there are. That is, in order to make channel length L small in the above-mentioned example, it is possible to make channel width W small first so that clearly from a formula (3). However, it is difficult for a limitation to be in detailed-ization of process top channel width W , and to make it detailed in a current thin film transistor process more sharply than above-mentioned extent. As an option, it is possible to make peak value $V_{gs}-V_{th}$ of driver voltage small. However, in order to perform gradation control in that case, it will be necessary to control the luminescence reinforcement of OLED by very small driver voltage width of face. For example, if it is going to control luminescence reinforcement by 64 gradation in the case of $V_{gs}-V_{th}=5\text{V}$, the electrical-potential-difference step per 1 gradation will be set to $5\text{V} / \text{about } 64=80\text{mV}$ on an average. Making this still smaller brings a result in which the display quality of an image is influenced by dispersion in few noises and TFT properties. Therefore, there is a limitation also in making peak value $V_{gs}-V_{th}$ of driver voltage small. It is possible to set process parameters, such as the carrier mobility μ which appears in a formula (3), as a suitable value as another solution. However, generally it is difficult to control a process parameter with a sufficient precision to a convenient value, and it is not economically realistic to build a manufacture process according to the specification of the image display device which it is going to design primarily at all. Thus, in the conventional active-matrix mold EL display, the degree of freedom of a pixel design is scarce, and it is difficult to perform a practical design.

[0013] Although connected also with the first trouble mentioned above, it is difficult as the second trouble to control the display brightness of the whole screen by the EL display of a active-matrix mold to arbitration. Generally, it is practically indispensable requirements that the display brightness of the whole screen can be adjusted free in image display devices, such as television. For example, when making screen intensity high when a perimeter uses an image display device under a bright situation, and using an image display device under a conversely dark situation, it is natural to stop screen intensity low. Accommodation of such screen intensity is easily realizable by changing the power of a back light in a liquid crystal display. Moreover, in the EL display of a passive-matrix mold, screen intensity can be adjusted comparatively easily by adjusting the drive current at the time of the address.

[0014] However, in the organic display of a active-matrix mold, it is difficult to adjust the display brightness as the whole screen to arbitration. As mentioned above, display brightness is proportional to the peak current I_p , and I_p is in inverse proportion to channel length L of TFT2. Therefore, although what is necessary is just to enlarge channel length L in order to lower display brightness, this cannot serve as a means by which a user chooses display brightness as arbitration. As a realizable approach, in order to lower brightness, it is possible to make peak value $V_{gs}-V_{th}$ of driver voltage small. However, if $V_{gs}-V_{th}$ is lowered, degradation of image quality will be caused by causes, such as a noise. Conversely, even if it is going to enlarge peak value $V_{gs}-V_{th}$ of driver voltage, it cannot be overemphasized that there is an upper limit by pressure-proofing of TFT2 etc. to raise brightness.

[0015]

[Means for Solving the Problem] the technical problem of a Prior art mentioned above -- taking an example -- this invention -- the design degree of freedom of the active element inside a pixel -- increasing -- a good design -- possible

** -- it is -- it aims at offering the image display device which can adjust screen intensity free and simple with **. The following means were provided in order to attain this purpose. The scanning line for choosing a pixel in a predetermined scan cycle and the data line which gives the brightness information for driving a pixel are arranged in the shape of a matrix. Namely, each pixel The first active element which has the function which writes the brightness information which was controlled by the light emitting device from which brightness changes with the amounts of currents supplied, and the scanning line, and was given from the data line in a pixel, The second active element which has the function which controls the amount of currents supplied to this light emitting device according to this ***** rare ***** is included. The writing of the brightness information to each pixel It is carried out by impressing the electrical signal according to brightness information to the data line, where the scanning line is chosen. In the image display device which can maintain lighting by the brightness according to the brightness information by which the brightness information written in each pixel was held at each pixel even after the scanning line was un-choosing, and the light emitting device of each pixel was held It has the control means which switches off compulsorily at least the light emitting device of each pixel connected to the same scanning line per scanning line. After brightness information is written in each pixel, while being the 1 scan cycle in which brightness information new next is written, by changing a light emitting device into a putting-out-lights condition from a lighting condition, it is characterized by controlling the time average brightness of this light emitting device.

[0016] Preferably, said control means can adjust the time of switching a light emitting device to a putting-out-lights condition from a lighting condition, while being the 1 scan cycle in which brightness information new next is written, after brightness information is written in each pixel. With 1 operation gestalt, the gate potential of this second active element is controlled with the control signal given to this third active element including the third active element connected to the gate of this second active element that consists of an insulated gate field effect transistor, said control means can switch off this light emitting device, and this control signal is given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel. With other operation gestalten, said control means can intercept the current which flows to this light emitting device according to the control signal given to this third active element including the third active element connected with this light emitting device at the serial, and this control signal is given to the third active element contained in each pixel on the same scanning line through each scanning line and the halt control line formed in parallel. With another operation gestalt, between the scanning lines, each light emitting device consists of a one terminal pair network component which has rectification, one terminal is connected to the second corresponding active element, common connection of the other-end child is made in each pixel on the same scanning line, and it dissociates electrically, and said control means controls the potential of the other-end child by whom common connection of the two terminal each component was made, and switches off a two terminal each component. Furthermore, with another operation gestalt, after brightness information is written in each pixel, while being the 1 scan cycle in which brightness information new next is written, said control means writes in the information which chooses the scanning line again and expresses brightness zero to each pixel from the data line, and switches off the light emitting device of each pixel. Furthermore, including the capacitive element by which the end was connected to the gate of the insulated gate field effect transistor which constitutes the second active element to which each pixel controls the amount of currents which flows to this light emitting device by another operation gestalt, by controlling the potential of the other end of this capacitive element, said control means controls the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switches off this light emitting device. Furthermore, said control means controls at least a lighting [of the light emitting device contained in each pixel], and putting-out-lights time by another operation gestalt per scanning line within the back 1 scan cycle by which brightness information was written in each pixel. Furthermore, with another operation gestalt, while connecting each pixel of red, green, and blue to the same scanning line in common, said control means switches off red, green, and the light emitting device contained in each blue pixel, when separate. In addition, said light emitting device is an organic electroluminescent element preferably.

[0017] In the image display device with which this invention turns on a pixel according to brightness information within the 1 scan cycle period when the second new brightness information is written in again after the first brightness information is written in a pixel The data line which gives the brightness information for being formed in the direction which intersects perpendicularly with the scanning line which chooses each pixel in a predetermined scan cycle, and this scanning line, and turning on the above-mentioned pixel, The first active element which is controlled by the above-mentioned scanning line and incorporates the above-mentioned brightness information, It is characterized by having the control means which controls the time average brightness of this light emitting device by having the second active element which converts the above-mentioned brightness information into the electrical signal used for the drive of the above-mentioned pixel, and changing the above-mentioned pixel into a putting-out-lights condition from a lighting

condition within the above-mentioned 1 scan cycle period. Preferably, adjustable is possible for the above-mentioned control means within the above-mentioned 1 scan cycle period in the time amount of a before [from the above-mentioned lighting condition / the above-mentioned lights-out]. Moreover, the second active element of the above is an insulated gate field effect transistor, the above-mentioned control means has the third active element connected to the gate of this insulated gate field effect transistor, and this third active element is controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel. Moreover, the above-mentioned control means has the third active element prepared in the second active element of the above at the serial, and this third active element is controlled by the above-mentioned scanning line and the control line formed in abbreviation parallel. Moreover, as for the above-mentioned light emitting device, the above-mentioned pixel has the first and the second terminal including a light emitting device, while the first terminal of the above is connected to the second active element of the above, the second terminal of the above is connected to predetermined reference potential, and the above-mentioned control means makes the above-mentioned light emitting device switch off by carrying out adjustable control of the above-mentioned reference potential. Moreover, the above-mentioned control means switches off this pixel by reselecting the above-mentioned scanning line within the above-mentioned 1 scan cycle period, and supplying to a pixel the brightness information which expresses brightness zero from the above-mentioned data line, after the above-mentioned scanning line is chosen. Moreover, including the capacitive element by which the end was connected to the gate of an insulated gate field effect transistor where each pixel constitutes this second active element, by controlling the potential of the other end of this capacitive element, the above-mentioned control means controls the potential of the gate of the insulated gate field effect transistor which constitutes said second active element, and switches off a pixel. Moreover, the above-mentioned control means switches off the above-mentioned pixel for every above-mentioned scanning line. Moreover, the above-mentioned pixel has the light emitting device of blue, green, and red, and the above-mentioned control means can switch off the light emitting device of this blue, green, and red by different time amount. Moreover, the second active element of the above converts brightness information into the current used for the drive of a pixel, and each pixel has a light emitting device using the organic substance which emits light according to a current. Moreover, the scanning-line drive circuit where the perpendicular clock for making sequential selection of the above-mentioned scanning line is inputted, It has the control circuit which chooses the control line which the predetermined perpendicular clock which carried out period delay was inputted, and formed the above-mentioned perpendicular clock in the above-mentioned scanning line or this, and parallel. The above-mentioned scanning line While sequential selection is made by the above-mentioned scanning-line drive circuit synchronizing with the above-mentioned perpendicular clock and turning on the above-mentioned pixel, synchronizing with the perpendicular clock by which delay was carried out [above-mentioned] in this control circuit, this pixel is switched off through the above-mentioned scanning line or the control line after this lighting within the above-mentioned 1 scan period. Furthermore, it has the data-line drive circuit which gives brightness information to the above-mentioned data line, and while the output of the above-mentioned scanning-line drive circuit is connected to one input terminal of the OR circuit where the output terminal was connected to the above-mentioned scanning line, the output of the above-mentioned control circuit is connected to one input terminal of the AND circuit connected to the input terminal of another side of the above-mentioned OR circuit, and the above-mentioned perpendicular clock is inputted into the input terminal of another side of this AND circuit.

[0018] According to this invention, after writing brightness information in each pixel per scanning line, before newly writing in the brightness information of the following scanning-line cycle (frame), an image display device bundles up the light emitting device contained in each pixel per scanning line, and is switched off. According to this, time amount until it puts out the light from lighting of the write-in late-coming light corpuscle child of brightness information can be adjusted. That is, the luminescence time amount in a 1 scan cycle can be adjusted comparatively (duty).

Accommodation of luminescence time amount (duty) is equivalent to adjusting the peak current I_p of each light emitting device equivalent. Therefore, it is possible by adjusting duty to adjust display brightness simple and free. Furthermore, an important point can enlarge I_p equivalent by setting up duty appropriately. For example, if duty is made into 1/10, brightness equivalent as for 10 times will be obtained in I_p . If I_p is increased 10 times, channel length L of TFT can be made into 1/10. Thus, it enables the design degree of freedom of TFT contained in a pixel by choosing duty suitably to perform increase and a practical design.

[0019]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained to a detail below. Drawing 1 expresses an example of the first operation gestalt of the image display device concerning this invention, and is a representative circuit schematic for 1 pixel. In addition, a corresponding reference number is given to the conventional pixel structure shown in drawing 10, and a corresponding part, and an understanding is made easy. Data-line Y which gives the brightness information for driving the scanning line X and Pixel PXL for this image display

device choosing Pixel PXL in a predetermined scan cycle (frame) is arranged in the shape of a matrix so that it may illustrate. The pixel PXL formed in the intersection of the scanning line X and data-line Y contains retention volume Cs with TFT1 which are a light emitting device OLED and the first active element, and TFT2 which is the second active element. Brightness changes with the amounts of currents to which a light emitting device OLED is supplied. TFT1 writes the brightness information which was controlled by the scanning line X and given from data-line Y in the retention volume Cs contained in Pixel PXL. TFT2 controls the amount of currents supplied to a light emitting device OLED according to the brightness information written in Cs. The writing of the brightness information to PXL is in the condition that the scanning line X was chosen, and is performed by impressing the electrical signal (data potential Vdata) according to brightness information to data-line Y. The brightness information written in Pixel PXL is held at retention volume Cs, also after the scanning line X is un-choosing, and a light emitting device OLED can maintain lighting by the brightness according to the held brightness information. It has the control means which switches off compulsorily at least the light emitting device OLED of each pixel PXL connected to the same scanning line X as a description matter of this invention per scanning line, and after brightness information is written in each pixel PXL, while being the 1 scan cycle in which brightness information new next is written, the time average brightness of this light emitting device is controlled by changing a light emitting device into a putting-out-lights condition from a lighting condition. It is possible for a control means to control the gate potential of TFT2 by this operation gestalt with the control signal given to the gate G of TFT3 including TFT3 (the third active element) connected to the gate G of TFT2, and to switch off OLED. This control signal is given to TFT3 contained in each pixel PXL on the scanning line which corresponds through the scanning line X and the halt control line Z formed in parallel. By making TFT3 into an ON state according to a control signal, retention volume Cs discharges, Vgs of TFT2 is set to 0V, and the current which flows to OLED can be intercepted. Common connection of the gate G of TFT3 is made, and it can perform luminescence halt control to the halt control line Z corresponding to the scanning line X per halt control-line Z.

[0020] Drawing 2 is the circuit diagram showing the whole image-display-device configuration which arranged on the matrix PXL shown in drawing 1. The scanning lines X1, X2, --, XN are arranged by behavior, and data-line Y is arranged by seriate so that it may illustrate. Pixel PXL is formed in the intersection of each scanning line X and data-line Y. Moreover, the halt control lines Z1, Z2, --, ZN are formed in the scanning lines X1, X2, --, XN and parallel. The scanning line X is connected to the scanning-line drive circuit 21. The scanning-line drive circuit 21 contains the shift register, and makes sequential selection of the scanning lines X1, X2, --, XN within a 1 scan cycle by carrying out the sequential transfer of the perpendicular start pulse VSP 1 synchronizing with the perpendicular clock VCK. On the other hand, the halt control line Z is connected to the halt control-line drive circuit 23. This drive circuit 23 also contains the shift register, and a control signal is outputted to the halt control line Z by carrying out the sequential transfer of the perpendicular start pulse VSP 2 synchronizing with VCK. In addition, as for VSP2, delay processing only of the predetermined time is carried out by the delay circuit 24 from VSP1. It connects with the data-line drive circuit 22, and data-line Y outputs the electrical signal corresponding to brightness information to each data-line Y synchronizing with line sequential scanning of the scanning line X. In this case, the data-line drive circuit 22 performs the so-called line sequential drive, and supply an electrical signal all at once to the line of the selected pixel. Or the data-line drive circuit 22 may perform the so-called point sequential drive, and may supply an electrical signal one by one to the line of the selected pixel. Anyway, this invention includes both line sequential drive and point sequential drive.

[0021] Drawing 3 is a timing chart with which explanation of the image display device concerning the first operation gestalt of this invention shown in drawing 2 of operation is presented. First, the perpendicular start pulse VSP 1 is inputted into the scanning-line drive circuit 21 and a delay circuit 24. After the scanning-line drive circuit 21 receives the input of VSP1, synchronizing with the perpendicular clock VCK, sequential selection of the scanning lines X1, X2, --, XN is made, and brightness information is written in Pixel PXL per scanning line. Each pixel PXL starts luminescence by the reinforcement according to the written-in brightness information. VSP1 is delayed in a delay circuit 24, and is inputted into the halt control-line drive circuit 23 as VSP2. After the halt control-line drive circuit 23 receives VSP2, it makes sequential selection of the halt control lines Z1, Z2, --, ZN synchronizing with the perpendicular clock VCK, and luminescence stops it per scanning line.

[0022] According to the first operation gestalt shown in drawing 1 thru/or drawing 3, it is a part for the time delay set up in general by the delay circuit 24 that each pixel PXL emits light after brightness information is written in until luminescence stops with a luminescence halt control signal. If the time delay is set to tau and time amount of a 1 scan cycle (one frame) is set to T, the time rate, i.e., duty, that the pixel is emitting light will serve as tau/T in general. The time average brightness of a light emitting device changes in proportion to this duty. Therefore, adjustable setting of the screen intensity of an EL display can be carried out in the simple and broad range by operating a delay circuit 24 and changing a time delay tau.

[0023] Furthermore, it enables it to perform the increase of the design degree of freedom of a pixel circuit, and a better design that control of brightness becomes easy. In the example of a pixel design of the conventional image display device shown in drawing 10, the size of TFT2 was decided as follows.

Channel width: $W = 5$ micrometers

Channel length: $L = \{W / (2, I_p)\}$ and $2 = 270$ micrometers of $\mu\text{-Cox-****}$

Such sizes of TFT2 correspond, when the duty of a light emitting device is 1. On the other hand, in the image display device concerning this invention, as mentioned above, duty can be beforehand set as a desired value. For example, duty can be set to 0.1. In this case, as an example of a design by this invention, the size of TFT2 shown in drawing 1 is reducible as follows.

Channel width: $W = 5$ micrometers

Channel length: $L = 270 \text{ micrometer} \times 0.1 = 27 \text{ micrometer}$

Other parameters presuppose that it is the same as that of the conventional example shown in drawing 10. In this case, although the current which flows to OLED at the time of luminescence becomes 10 times according to a formula (1), since duty is set to 0.1, the drive current in a time average becomes the same as the conventional example. With an organic EL device, since a current and brightness are usually in proportionality, the luminescence brightness of a time average becomes equivalent by the conventional example and this invention. On the other hand, in the example of a design of this invention, channel length L of TFT2 is sharply miniaturized with 1/10 of the conventional examples. Since the pulse duty factor of TFT2 in the interior of a pixel falls sharply and a large occupancy area (luminescence field) of an organic EL device can be taken as a result by this, image grace improves. Moreover, detailed-ization of a pixel also becomes realizable easily.

[0024] Drawing 4 is the whole circuitry Fig. showing an example of the second operation gestalt of the image display device concerning this invention. A corresponding reference number is given to the first operation gestalt shown in drawing 2, and a corresponding part, and an understanding is made easy. To the first operation gestalt being the image display device of monochrome, this operation gestalt is the image display device of a color, and accumulation formation of the pixel PXL to which RGB three primary colors were assigned is carried out. With this operation gestalt, while connecting each pixel PXL of red, green, and blue to the same scanning line X in common, each pixel of red, green, and blue is separately connected to the halt control lines Z_R , Z_G , and Z_B . When separate, it enables it to switch off by this red, green, and the light emitting device contained in each blue pixel. Specifically corresponding to the pixel PXL of RGB 3 color, three halt control-line drive circuits 23_R , 23_G , and 23_B are formed separately. Moreover, corresponding to these halt control-line drive circuits 23_R , 23_G , and 23_B , delay circuits 24_R , 24_G , and 24_B are formed separately, respectively. therefore, RGB -- separately, the time delay of VSP1 can be set up and VSP2R, VSP2G, and VSP2B can be supplied to the corresponding halt control-line drive circuits 23_R , 23_G , and 23_B . A red pixel (R) is connected to the halt control line Z_R controlled by halt control-line drive circuit 23_R , a green pixel (G) is connected to the halt control line Z_G controlled by halt control-line drive circuit 23_G , and a blue pixel (B) is connected to the halt control line Z_B controlled by halt control-line drive circuit 23_B . According to this configuration, brightness can be adjusted for every color of RGB. Therefore, it is possible for chromaticity accommodation of a color picture indicating equipment to become easy, and to take a color-balance simply by adjusting appropriately the time delay of delay circuits 24_R , 24_G , and 24_B . That is, it is possible to observe a screen, and to weaken a redness component by adjusting the time delay of delay circuit 24_R , and making duty corresponding to red small relatively, when a redness component is too strong.

[0025] Drawing 5 is the representative circuit schematic for 1 pixel showing an example of the third operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the first operation gestalt shown in drawing 1, and a corresponding part, and makes an understanding easy. This operation gestalt can intercept the current which flows to a light emitting device OLED according to the control signal given to TFT3 including TFT3 (the third active element) connected with the light emitting device OLED at the serial. A control signal is given to the gate G of TFT3 contained in each pixel PXL on the same scanning line through the scanning line X and the halt control line Z formed in parallel. With this operation gestalt, TFT3 is inserted between touch-down potential and TFT2, and the current which flows to OLED by control of the gate potential of TFT3 can be turned on / turned off. In addition, it is also possible to insert TFT3 between TFT2 and OLED or between OLED and Vdd.

[0026] Drawing 6 is the representative circuit schematic for 1 pixel showing an example of the fourth operation gestalt of the image display device concerning this invention. A corresponding reference number is given to the conventional example shown in drawing 10, and a corresponding part, and an understanding is made easy. With this operation gestalt, a light emitting device OLED consists of a one terminal pair network component which has rectification, one terminal (cathode K) is connected to TFT2, and the other-end child (anode A) is connected to the halt control line Z . At each pixel on the same scanning line, common connection of the anode A of a one terminal pair network component is made

at the halt control line Z, and it dissociates electrically between the different scanning lines. in this case, the potential of the other-end child (anode A) by whom common connection of the one terminal pair network component was made -- the halt control line Z -- controlling -- every -- OLED is switched off. However, the anode A of OLED is not connected to Vdd of fixed potential like before, but the potential is controlled from the exterior through the halt control line Z. Although the current controlled by TFT2 flows anode potential to sufficiently high value, then OLED, since OLED has rectification with a one terminal pair network component, it can turn off the current which flows to OLED by making anode potential into sufficiently low potential (for example, touch-down potential).

[0027] Drawing 7 is a timing chart which shows the example of control of the fourth operation gestalt shown in drawing 6. The 1 scan cycle (one frame) is expressed with T. In the write-in period (RT) located in the head of the 1 scan cycle T, brightness information over all pixels is written in by line sequential. That is, in this example, brightness information is written in the high speed at all pixels using a part of 1 scan cycle. After writing is completed, the halt control lines Z are controlled all at once, and OLED contained in each pixel is turned on. Thereby, OLED of each pixel starts luminescence according to the written-in brightness information, respectively. Progress of the after predetermined time delay τ drops the anode A of all OLED(s) to touch-down potential through all the halt control lines Z. Thereby, luminescence becomes off. The above control can adjust duty τ/T in all pixel units. In addition, this invention is not restricted to this and you may make it control ON/OFF of each pixel per scanning line at least. As mentioned above, a lighting [of the light emitting device contained in each pixel] and putting-out-lights time is controllable by this example of control per a screen unit or scanning line within the 1 more scan cycle by which brightness information was written in each pixel.

[0028] Drawing 8 is the whole circuitry Fig. showing an example of the fifth operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the conventional example shown in drawing 11, and a corresponding part, and makes an understanding easy. This operation gestalt is performing duty control of each pixel PXL using the scanning line X1 thru/or XN, without forming the special halt control line unlike a previous operation gestalt. For this reason, control circuit 23' is prepared independently [the scanning-line drive circuit 21]. Each output terminal of control circuit 23' is connected to one corresponding input terminal of each AND gate circuit 28. The output terminal of each AND gate circuit 28 is connected to each scanning lines X1, X2, --, XN through one input terminal of the OR gate circuit 29 of the next step. VCK is supplied to the other-end child of each AND gate circuit 28. In addition, each output terminal of the scanning-line drive circuit 21 is connected to each scanning lines X1, X2, --, XN through the corresponding input terminal of another side of each OR gate circuit 29. Moreover, VSP1 turns into VSP2 through a delay circuit 24 like a previous operation gestalt, and is supplied to control circuit 23'. On the other hand, each data-line Y is connected to the data-line drive circuit 22 through TFT26 of a P channel mold. VCK is supplied to the gate of TFT26. Moreover, the potential of each data-line Y is controllable also by TFT27 of N channel mold. VCK is supplied also to the gate of TFT27. Thus, although the circumference circuitry of this image display device differs from the conventional example shown in drawing 11, the circuitry of each pixel PXL is the same as the conventional pixel circuitry shown in drawing 10. By this configuration, after brightness information is written in each pixel PXL, while being the 1 scan cycle in which brightness information new next is written, control circuit 23' can write in the information which chooses the scanning line X again and expresses brightness 0 to each pixel PXL from data-line Y, and can switch off the light emitting device OLED of each pixel PXL.

[0029] Drawing 9 is a timing chart with which explanation of the fifth operation gestalt shown in drawing 8 of operation is presented. The perpendicular start pulse VSP 1 is inputted into the scanning-line drive circuit 21 and a delay circuit 24 so that it may illustrate. After the scanning-line drive circuit 21 accepts VSP1, it makes sequential selection of the scanning lines X1, X2, --, XN synchronizing with the perpendicular clock VCK, and writes brightness information in each pixel PXL per scanning line. Each pixel starts luminescence by the reinforcement according to the written-in brightness information. However, with this operation gestalt, by having formed TFT 26 and 27, each data-line Y becomes the potential (this example touch-down potential) which is equivalent to brightness 0 in the period of $VCK=H$ (high-level), and original brightness information is given in the period of $VCK=L$ (low level). This relation gives L and H to the wave of VCK of drawing 9, gives hatching to the wave of the data line, and has expressed it to it typically. After VSP1 is delayed in a delay circuit 24, it is inputted into control circuit 23' as VSP2. The output is inputted into the AND gate circuit 28, although control circuit 23' operates synchronizing with the perpendicular clock VCK after accepting VSP2. since VCK is inputted into coincidence in each AND gate circuit 28 -- the output of control circuit 23' - H (high-level) -- and the scanning line X is chosen at the time of $VCK=H$ (high-level). Since the potential with which the period of $VCK=H$ is equivalent to brightness 0 at each data-line Y is given as mentioned above, luminescence stops the pixel connected to the scanning line X chosen by control circuit 23' using the information equivalent to brightness 0.

[0030] Drawing 14 is the representative circuit schematic for 1 pixel showing an example of the sixth operation gestalt of the image display device concerning this invention, gives a corresponding reference number to the first operation gestalt shown in drawing 1, and a corresponding part, and makes an understanding easy. With each previous operation gestalt, although there are many things with the need of adding a transistor in order to switch off a pixel, the additional transistor of this operation gestalt is unnecessary, and it has more practical composition. The other-end child of the capacitive element Cs connected to the gate G of the transistor TFT2 which controls the amount of currents supplied to a light emitting device OLED is connected to the luminescence halt control line Z so that it may illustrate. The potential of the luminescence stop line Z is lowered after write-in termination (example of this drawing). For example, the capacity of a capacitive element Cs serves as change of the gate potential of the potential change 2 of the luminescence halt control line Z, i.e., TFT, when sufficiently large compared with the gate capacitance of TFT2 etc. Therefore, when maximum of the gate potential of TFT2 at the time of writing is set to V_{gmax} , by lowering the potential of the luminescence halt control line Z more than $V_{gmax} - V_{th}$ from the time of writing, gate potential of TFT2 can be made below into V_{th} , therefore a light emitting device OLED is switched off. It is desirable to control by the big amplitude to a slight degree in consideration of the gate capacitance of TFT2 etc. in fact.

[0031] Drawing 15 is a timing chart with which explanation of the sixth operation gestalt shown in drawing 14 of operation is presented. The halt control line is made in general into a high level with scanning-line selection at coincidence, and the period when a high level after write-in termination is maintained, and a light emitting device will be in a luminescence condition by the brightness according to the written-in brightness information so that it may illustrate. If the halt control line is made into a low before writing in new data with the following frame, a light emitting device will be switched off.

[0032] By the way, in CRT, the display image serves as a display principle of the maintenance mold which continues displaying the image between one frame on the display of a active-matrix mold to brightness declining by msec order. When performing a movie display for this reason, the pixel which met the profile of an animation shows the image, until just before a frame switches, and this senses it as if the image was conjointly displayed as the after-image effectiveness of human being's eyes there also with the following frame. This is the cause of fundamental that the image quality of the movie display in a active-matrix mold display becomes low as compared with CRT. As this solution, the drive approach concerning this invention is effective, and the improvement of the quality of an animation can be aimed at by introducing the technique of severing the after-image which switches off a pixel compulsorily and is felt by human being's eyes. In the display of a active-matrix mold, while displaying an image in the first half of one frame, specifically, that method of switching off an image which CRT brightness decreases is adopted like the second half of one frame. For the nature improvement of an animation, the duty of per frame, lighting, and putting out lights is set up to about 50%. Furthermore, for the high nature improvement of an animation, it is good to set up the duty of per frame, lighting, and putting out lights to 25% or less.

[0033]

[Effect of the Invention] Since luminescence of a pixel can be stopped according to this invention before the writing of the following frame is performed after brightness information is written in each pixel and luminescence begins as explained above, the luminescence time amount within one frame can be changed comparatively (duty), and it is possible for this to adjust the display brightness of a time average simple. Furthermore, since the degree of freedom which sets up suitably the amount of currents which flows to a light emitting device at the time of luminescence arises keeping the display brightness of a time average the same by the ability setting up duty freely, a degree of freedom produces an important thing in the design of the active element which controls the amount of currents which flows to a light emitting device. Consequently, it becomes possible to design the image display device which can offer a more nearly high-definition image, and the image display device of smaller pixel size.

[Brief Description of the Drawings]

[Drawing 1] It is the pixel circuit diagram showing the first operation gestalt of the image display device concerning this invention.

[Drawing 2] It is the whole first operation gestalt circuitry Fig.

[Drawing 3] It is the timing chart of the first operation gestalt.

[Drawing 4] It is the whole second operation gestalt circuitry Fig. of the image display device concerning this invention.

[Drawing 5] It is the pixel circuit diagram showing the third operation gestalt of the image display device concerning this invention.

[Drawing 6] It is the pixel circuit diagram showing the fourth operation gestalt of the image display device concerning this invention.

[Drawing 7] It is the timing chart of the fourth operation gestalt.

[Drawing 8] It is the whole circuitry Fig. showing the fifth operation gestalt of the image display device concerning this invention.

[Drawing 9] It is the timing chart of the fifth operation gestalt.

[Drawing 10] It is the pixel circuit diagram showing an example of the conventional image display device.

[Drawing 11] It is the conventional whole image-display-device circuitry Fig.

[Drawing 12] It is the pixel circuit diagram showing other examples of the conventional image display device.

[Drawing 13] It is the sectional view showing the structure of the conventional image display device.

[Drawing 14] It is the representative circuit schematic for 1 pixel showing an example of the sixth operation gestalt of the image display device concerning this invention.

[Drawing 15] It is the timing chart with which explanation of the sixth operation gestalt shown in drawing 14 of operation is presented.

[Description of Notations]

PXL [... The second active element, TFT3 / ... The third active element, Cs / ... Retention volume, X / ... The scanning line, Y / ... The data line, Z / ... The halt control line, 21 / ... A scanning-line drive circuit, 22 / ... A data-line drive circuit, 23 / ... A halt control-line drive circuit, 24 / ... Delay circuit] ... A pixel, OLED ... A light emitting device, TFT1 ... The first active element, TFT2

[Translation done.]